THE MARINE REVIEW

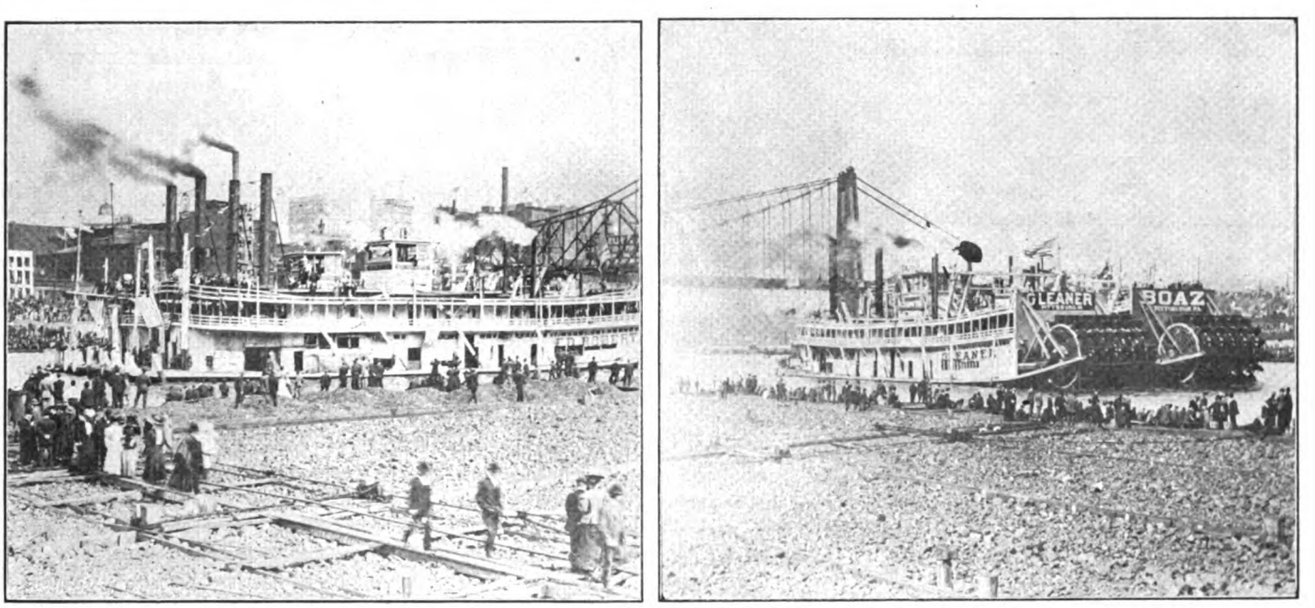
VOL. 38. CLEVELAND, OCTOBER 15, 1908. NEW YORK No. 16

Pittsburg's Sesqui-Centennial Celebration.

Led by the most primitive form of navigation upon these streams, the Indian in his canoe, an imposing marine parade was held on the Monongahela and Ohio rivers at Pittsburg, Sept. 30, in connection with the celebration of the city's sesqui-centennial anniversary. The pageant, which was one of the most notable ever given on an inland waterway, was spectacular in many respects. Historical events of the early settlement period which had actually taken place upon the rivers near the sites of old Forts Pitt and Duquesne, were represented by various craft manned by crews appropriately costumed. The parade also served as an exemplification of the great advance made by the commerce of the rivers and of the progress in boat construction within the lapse of 150 years.

Coal boats, tow boats, modern and Indian canoes, dredge boats, sand diggers, motor boats, barges and river craft of al description gaily decorated in the national colors and the orange and black of the city of Pittsburg, made a memorable spectacle for the thousands of people who lined the banks of the streams along the entire course.

The parade was led by a fleet of Indian canoes which were paddled by Thos. W. Jacobs, a direct descendant of the Seneca chief, Gyanwahia (Corn Planter), once the principal chief of the Six Nations, who was present at Braddock's defeat, and by 30 other Indians from a reservation in Pennsylvania. The Indians wore buckskins, feathers and paint. Following these were two vessels known as the La Salle and Celeron, representing the days when the French were in possession of the Allegheny and Monongahela rivers. The remainder of the parade was made up as follows: A barge representing the first trip down the river of Washington and Gist; a large house boat, illustrating emigrants going west; a raft of timber, as operated about 1812; steamer New Orleans, the first boat to ply



PITTSBURG'S SESQUI-CENTENNIAL CELEBRATION.

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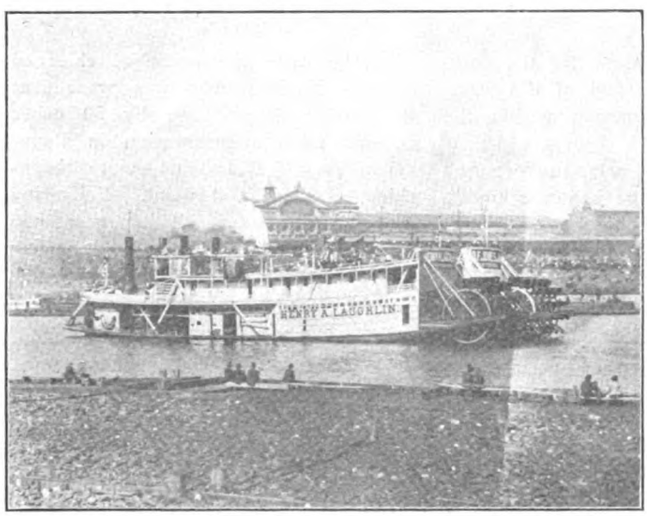
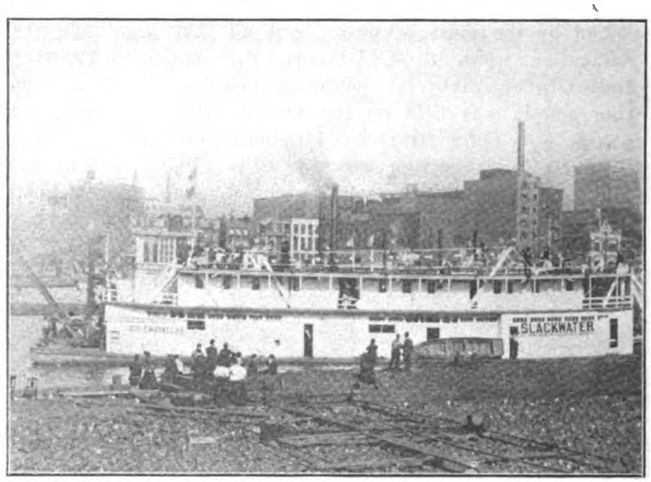
the local streams, which made its first trip down the Ohio river in 1811; floating coal boats, representing the manner in which coal boats operated on the local streams in 1835; steamers Harry Lourey and the Duquesne, the flag boats of the squadron; the I. C. Woodward, Columbia and Sunshine in triple file; the Gleaner and Boaz; the Ed Roberts and Tom Dodsworth, carrying both branches of city councils; Raymond Horner and Alice Brown; Monitor and the Crescent; the Rival and the Volunteer; Charley Clark and Dave Wood; the G. W. Thomas and A. R. Budd; H. A. Laughlin and B. F. Jones; Vulcan and Vesta; Braddock and Juniata; Clyde and Volcano; T. P. Roberts and Slackwater; W. C. Jutte and P. M. Pfeil; Bertha and Crusader; Carbon and Clipper; H. P. Dilworth and John F. Klein; Lee H. Brooks and Diamond; Ella B. and W. T. Smoot; Independent and Progress; Ed Davison and National and the Rebecca and Harriet. Following these boats came a flotilla of 250 motor boats, beautifully decorated.





PITTSBURG'S SESQUI-CENTENNIAL CELEBRATION.

The British submarine C17, the first of its class to be built in one of the Royal dock yards, was launched last month at Chatham. The ceremony was of a private character, and the vessel herself has been built under conditions of secrecy, the ship way being enclosed and all the workmen required to take oath not to divulge any information about her. Her dimensions are: Length, 130 ft.; beam, 13 ft. 6 in.; displacement, 313 tons when submerged; engines, 600 H. P., to give a speed of 13 knots on the surface.

THE PACIFIC COAST PROTESTS AGAINST FOREIGN COLLIERS.

George F. Thorndyke's powerful letter on the present depressed condition of Pacific coast shipping, which was published in the MARINE REVIEW of Sept. 17, was referred by the Seattle chamber of commerce to its committee on steamships. The committee considered the letter in detail, verified the statements made therein and has recently reported in part as follows:

"Unless the policy of the navy department is altered so that ways and means are devised whereby these foreign tramps may be prohibited from competing with the American bottoms and with the regular lines, the Pacific shipping interests will be unable to secure living rates for their vessels. The mammoth tonnage of foreign tramp steamships, making deliveries for the government from the Atlantic to various ports on the Pacific coast, and then accepting business, on departure, at reduced rates, in effect makes the government responsible for a policy directly contrary to its expressed intention of encouraging and assisting the American merchant marine.

"It is evident that this condition will continue indefinitely, for despite the fact that the Atlantic battleship fleet has now left these waters, the Pacific cruiser fleet remains, and the government will undoubtedly continue the policy of chartering foreign bottoms with which to supply this latter fleet with Atlantic coast coal. The Pacific cruiser fleet is a large consumer of fuel, and its continued presence in these waters means that the above condition referred to will continue to exist unless the navy department inaugurates a policy which will deprive these foreign bottoms under charter of the privilege of competing with our own ships for outward cargoes.

"Under the circumstances, we respectfully submit that the department should, at least, pursue a policy in harmony with that of the government, in that the latter is committed to the policy of encouraging the maintenance and upbuilding of American shipping on the high seas, and to this end your committee respectfully recommends that the active support and cooperation of every senator and representative on the Pacific coast be enlisted to unite in a protest against the continuance of the policy above referred to.

"Your committee understands that a conference is shortly to be held in San Francisco by the executive officers of the leading commercial bodies on the Pacific coast, at which the United States senators, representing the several states bordering the Pacific, will be present, and we urge that the officers of this chamber be given authority to bring to the attention of those in attendance at the conference, the conditions above referred to, and urge upon not only the executive officers of the commercial bodies, but senators as well, the necessity for prompt and concerted action in lodging a protest with the navy department, which will bring about a prompt abandonment of the present policy in chartering the foreign bottoms to bring fuel from the Atlantic to the Pacific.

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"It has been suggested that the government might be able to transport this coal by rail, if the transcontinental railroads would make a concession in the matter of rates. In the event this is found to be practicable, it will serve a double purpose, in that it will not only remove the necessity for chartering these foreign tramps, but would insure a sufficient supply of empty cars for western states, with which to transport their lumber and other products to eastern markets.

"It has also been suggested that coal, of a quality similar to that purchased on the Atlantic seaboard, can be secured in British Columbia; and while your committee does not desire to be put in the position of advocating the purchase of fuel in a foreign country, it is nevertheless a fact that, under existing conditions, tramp steamer owners are paid a greater volume of money, by American institutions, than if this coal was purchased in British Columbia, for the reason that the charter rate now being paid on coal from the Atlantic, amounts to a sum greater than the sum for which the fuel could be purchased in British Columbia."

The above report was adopted by the chamber of commerce on Sept. 15. In accordance with the recommendations contained therein the present deplorable condition of Pacific shipping and the causes producing this condition will be forcibly brought to the attention of all those in attendance at the meeting of the executive officers of the commercial bodies of the Pacific coast, together with the Pacific coast members of congress, which convenes in San Francisco Oct. 5.

BATTLESHIP NORTH DAKOTA.

Herewith are published photographs showing the battleship North Dakota, building at the Fore River ship yard. The photographs were taken on Oct. 1 and show the vessel 54.2 per cent completed. The Fore River company advises that the North Dakota will be launched about noon time on Nov. 10.

The Nicholson speed indicator and ship's log which was presented to the board of supervising inspectors at their meeting in Washington in January last, was adopted by the board on Feb. 19 and has received the approval of the secretary of commerce and labor. The Nicholson Ship Log Co. has been so notified by the supervising inspector of the steamboat inspection service.

BRISK ATLANTIC TRAVEL.

Contrary to the general belief the steamship business of trans-Atlantic lines has not suffered to any great extent on account of the depression, and especially is this true with regard to cabin business. Representatives of the large lines contend that the increase in the minimum rate has had nothing to do with what little decrease there has been, preferring to attribute it to the economical and industrial conditions prevailing.

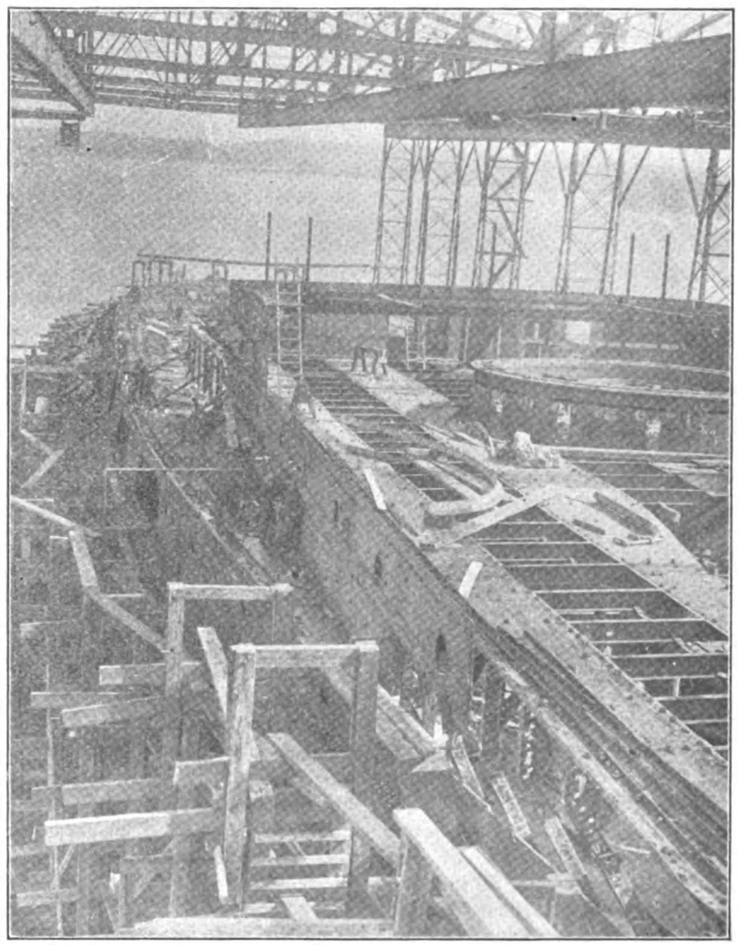
A representative of the North German Lloyd Co., said:

"The figures compiled by the steamship conference are authentic and show that higher minimum rates have had nothing to do with the slight decrease in cabin business in the period from Jan. 1, 1908, to Sept. 11, 1908, the period of the last report. The decrease during this period in 1908 over the same period in 1907 is but 3.58 per cent, and it is believed that this decrease will be wiped out by the end of the year.

"From Jan. 1, 1908, to Sept. 11, 1908, the eastbound or "outward bound" first-cabin passengers, numbered 77,093, while for the same period in 1907, 80,795 passengers were carried, a decrease in 1908 over 1907 of 2,892.

"In the second-cabin, eastbound business, for the same period, there is an increase in 1908 over 1907 of 3.45 per cent. Up to Sept. 11, 1908, 84,973 passengers sailed, while for the corresponding period in 1907, but 82,139 left the United States, an inincrease in 1908 over 1907 of 2,834 passengers in the eastbound second-cabin business.

"In the westbound or 'Incoming' first-cabin business there is a decrease during 1908 over 1907 of 11.57 per cent; the figures being for 1908, 53,780, and for 1907, 60,821, a decrease in 1908 over 1907 of 7,041 passengers. In the second-cabin westbound or 'incoming' business the decrease in 1908 over 1907 is more marked and amounts to 31.49 per cent. But to attribute higher minimum rates as the cause for this decrease is absurd. It is well known that conditions in the United States during the past



BATTLESHIP NORTH DAKOTA 54.2 PER CENT COMPLETED.

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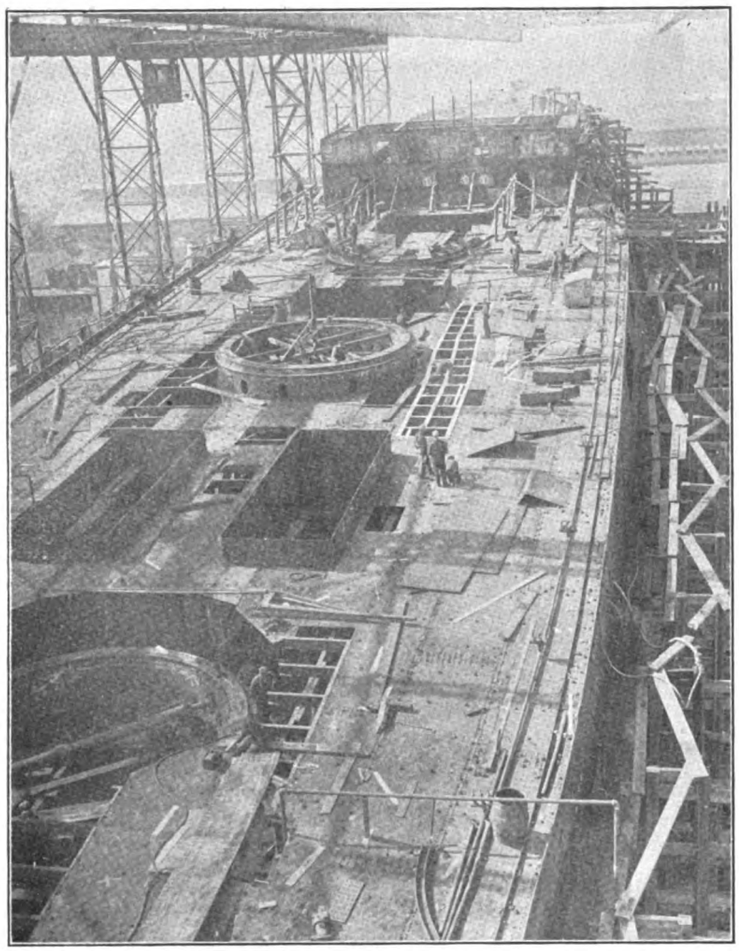


BATTLESHIP NORTH DAKOTA 54.2 PER CENT COMPLETED.

year have not been such as to attract the better class of immigrants, or in fact, immigrants of any kind. This is especially true of the better class of immigrants, who do not travel in the steerage, but in the second cabin. Reports of 'hard times' in the United States have reached them and they are awaiting more favorable conditions before coming to the United States.

"The figures for 1908, up to Sept. 11, for westbound or 'incoming' second-cabin business are 103,936, and for 1907, 151,698, a decrease in 1908 over 1907 of 47,762 passengers.

"That conditions in the United States and not higher minimum rates or other rates are responsible for the falling off in this season's business is shown by the remarkable immigration figures for 1908 and 1907. During the period from Jan. 1, 1908, to Sept. 11, 1908, the date of the last report, but 260,472 immigrants landed in the United States, while for the same period in 1907, 1,009,351 had come here.

"The same conditions are responsible for the extraordinary eastbound travel of the foreign labor element. At the beginning of the period of industrial depression which began last fall, the outward movement started and has been continuous up to the present time.

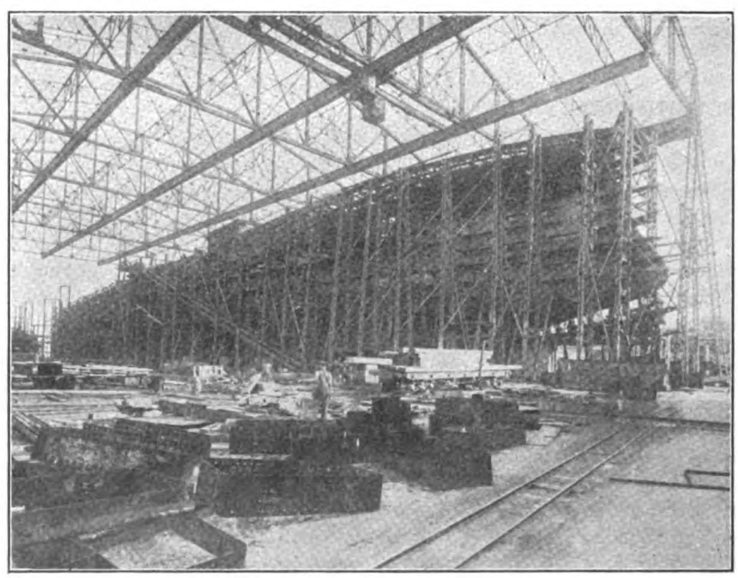
"The outward movement was caused by the failure of the foreign labor element to secure employment. The supply exceeded the demand, and the men who could not get work, gathered their savings and went to their homes abroad, where they could live cheaper and wait for industrial conditions to improve sufficiently to warrant their return.

"During the period from Jan. 1, 1908, to Sept. 11, 1908, 517,766 of the foreign laboring element left the United States, while for the same period in 1907, but 268,612 went abroad."

FOREST CENSUS.

Washington, Oct. 5.—The national conservation commission has caused the first comprehensive attempt at a census of the standing timber in the United States ever undertaken. The forest service has for several years been eager to take such a census, and the bureau of the census has expressed its willingness to co-operate, but funds have never been available. The conservation commission, however, needs the information to help complete its inventory of the country's natural resources, which it will include in its report to the president, and since that report is to be submitted on the first of next year, it needs the information at once. In consequence the work on the census has been started with a rush and is now under full headway.

It may be a slight exaggeration to speak of a census of timber, for of course it is impossible to count the individual trees in the forests; even the



BATTLESHIP NORTH DAKOTA 54.2 PER CENT COMPLETED.

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most ambitious plans of the forest service and the bureau of the census did not contemplate that. But a trained man can with great accuracy "cruise" a tract of forest and estimate the number of board feet it contains. Large portions of the forests of the country, including practically all the national forests, have been estimated at various times, but these figures have never been brought together and no organized effort has ever been made to gather them into one total, nor to supply the deficiencies where hitherto no estimates have been made.

As a result, the guesses as to the amount of standing timber in the United States, range all the way from 822,682 million to 2,000 billion board feet—a difference of more than a trillion feet in the estimates of the best qualified authorities in the country.

In the opinion of the forest service, the most carefully prepared estimates yet made are those by Henry Gannett, published by the twelfth census in 1900. These placed the total stumpage at 1,390 billion board feet. Mr. Gannett, it so happens, has been chosen by the president to compile all the information gathered for the commission, and with his previous acquaintance with the subject of forestry, he is at work now enlarging the knowledge of forest areas at present available.

The importance of this census lies largely in the fact that it will give an accurate basis for computing how long our timber supplies will last. Through the co-operation of the forest service and the census bureau the cuntry's annual consumption of wood is known with tolerable accuracy, although even here there are some discrepancies, because a large amount of wood is used for posts, fuel, and domestic purposes, for which no satisfactory data have yet been collected. But the census of opinion among those equipped to judge is that the present annual consumption is about 100 billion board feet, or something more than that. One leading authority has placed it as high as 150 billion board feet.

Assuming a stumpage of 1,400 billion feet, an annual use of 100 billion feet, and neglecting growth in the calculation, the exhaustion of our timber supply is indicated in 14 years. Assuming the same use and stand, with an annual growth of 40 billion feet, we have a supply for 23 years. Assuming an annual use of 150 billion feet, the first supposition becomes 9 years, and the second 13 years. Assuming a stand of 2,000 billion feet, a use of 100 billion feet, and neglecting growth, we have 20 years' supply. Assuming the same conditions, with an annual growth of 40 billion feet, we have 33 years' supply. With an annual use of 150 billion feet, these estimates become, respectively, 13 and 18 years.

It is apparent from these computations why the national conservation commission considers the census of timber so essential to the preparation of its inventory.

The chief difference between the methods now being employed by the conservation commission and those the bureau of the census would use are, that while the bureau would send out enumerators to make personal visits to all parts of the country, the commission is aiming at the same results through a tremendous amount of correspondence. For instance, 3,100 letters have gone out to county clerks, asking for statements of forest areas in their counties. Seven thousand lumbermen and timberland owners have been asked to supply similar information. In all nearly 150,000 letters have been sent. These letters also ask for a wide variety of information beside the area and capacity of forests. They touch upon all phases not only of the lumbering and milling industries, but of all others which are even indirectly dependent upon the use of wood. The purpose of the commission is not merely to learn how much wood is growing now, but how long it may be expected to last and how the supply may be prolonged by economy.

All government departments and bureaus which have any information about forests, as well as many large corporations, such as land grant railroads which hold big forest tracts in some states and have cruised them carefully, have turned it over to Mr. Gannett.

The forest service naturally has the largest fund of information, and it is gathering more constantly, either independently or with the help of the census bureau. The departments of war, the interior, the commerce and labor can turn over the amounts of timber standing on military, lighthouse, and other reservations. The bureau of corporations of the department of commerce and labor has sent out an extensive schedule of inquiries to its special agents which, it is hoped, will add to the present information concerning the manufacture of wood. All the states of the union are co-operating and will furnish statistics concerning state forest lands.

The Harlan & Hollingsworth Corp., Wilmington, Del., has a contract for four covered steel steam lighters for the Central Railroad of New Jersey for service in New York harbor.

PRODUCER GAS.*

BY J. EMERSON DOWSON, M. INST. C. E.

My first paper on this subject was read at the York meeting of the association in 1881, and after a lapse of over a quarter of a century I think it may be useful to take some account of the progress which has been made, and to offer a few passing remarks which practical experience seems to suggest.

The first internally-fired gas producer was devised by Bischof in 1839, but little progress was made in our country until the late Sir William Siemens introduced the combined gas producer and regenerative furnace invented by his brother, Frederick Siemens, in 1857. It is too well known to need description, but I may remind you that it depended on the siphon action of a long cooling tube which caused an indraft of air to the producer, and made the gas flow to the furnace. In connection with this producer Siemens used various furnaces of special construction, and, in all, he heated the ingoing air and reheated the gas by the outgoing products of combustion, the currents being reversed at short intervals. This was his regenerative system, and with it he attained exceedingly high temperatures with a low consumption of fuel. Since then various improvements have been made, the siphon tube has been abandoned, and the reversals of the currents are only used in special cases, as they occasionally lead to troublesome explosions. The more modern practice is to work the producer with a jet of steam at pressure which injects air, and the gas is delivered to the furnace at pressure; the cooling of the gas is thus avoided, and the hot gas flows continuously in one direction from the producer to the furnace. Only the air is heated by the outgoing products of combustion. In this way no unburnt gas can reach the air before the two meet in the combustion chamber, consequently there is no risk of explosion in the flues. The process is simplified, and the cost of construction and the ground space required are lessened. This type of furnace is extensively used for a great variety of purposes, and manufacturers are now fully alive to its many advantages. Its success, however, has been chiefly due to the heating of the air by the waste heat of the products of combustion, and for this useful outcome of theory and practice we are certainly indebted to the brothers Siemens. In this connection I may men-

*Read before section G of the British Association at Dublin, Sept. 7, 1908.

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tion that I have often been consulted by manufacturers and others who have had the idea that if they converted the coal into gas, in a producer, they could burn the gas with cold air in an ordinary coal-fired furnace, and get the same high temperature as with a coal fire. This is impossible, as about 50 per cent of the producer gas consists of nitrogen, and the nitrogen content of the products of combustion is also high; the calorific power of the gas is therefore low, while the heat capacity of the products is comparatively high. The flame temperature is consequently low, especially if the gas is burnt with cold air. To attain high temperatures in a furnace with producer gas at low pressure it is not only desirable that the gas should be hot, but it is essential to heat the air, and obviously the most economical way of doing this is with the waste heat of the products of combustion. When worked in this way, in a fairly large furnace, it is not difficult to attain a temperature of 1500 deg. Cent. (2730 deg. Fahr.), and still higher temperatures can be reached if special arrangements are made.

In connection with furnace work I should not forget to mention Dr. Mond's system of making producer gas with recovery of ammonium sulphate as a by-product. This plant can only be used on a large scale, and it needs coal containing a rather high percentage of nitrogen, as the formation of ammonia gas is an essential part of the process. A large excess of steam is sent into the producer to prevent the destruction of the ammonia gas, which is afterwards recovered as a sulphate by mixing it with free sulphuric acid. The gas which leaves this plant, after being washed, etc., has about the same calorific power, and about the same flame temperature, as ordinary producer gas. The advantage to the manufacturer is that the by-product reduces the cost of the fuel; but out of this saving he must pay for interest on the capital outlay, and for the wear of a rather complicated and costly plant.

For furnaces heated by producer gas large flames are required, and the gas is burnt in large quantities; also when it is taken direct from the producer to the furnace, it retains a considerable amount of sensible heat, and the tarry vapors which accompany the gas are not condensed; they burn with the gas, and increase its calorific power and flame temperature. Many other kinds of heating work require the use of burners and small flames, and for these it is essential that the gas should be clean and of good quality. It cannot be taken direct from the producer to small burners, or they would soon be clogged with troublesome deposits. In practice it is usual for such purposes to pass the gas through water and scrubbing material, such as coke and sawdust. The gas is cooled to about the temperature of the surrounding air, and this not only means that nearly all the sensible heat which the gas carries with it from the producer is lost, but that any condensable hydrocarbons which leave the producer in the form of tarry vapors are also lost. It is therefore important that the gas itself should be of good quality, or it will not bear these losses, and will not be strong enough to burn well in small jets. When burners are used it is also important that the gas pressure at the burners should be constant, so that the heat given off by the flames may be kept uniform, or varied at will by cocks on the supply pipes. For this reason the gas must be passed through a gas holder, or its pressure must be regulated in some equally efficient manner. Sometimes a fan is used to draw gas from the gas plant, and deliver it at pressure to the burners, but this always seems to me a rather hand-to-mouth arrangement, and if there is any variation in the speed of the fan, or if it gets clogged, or if from any cause it does not work well, there must be variations in the pressure of the gas, and consequent variations in the flames. Speaking with a considerable amount of experience, I recommend a gas holder as better than any other device. It may be quite small, unless storage of gas is required, but it relieves the consumer of a certain amount of anxiety and trouble. In most cases it is also safer to use a gas holder, as it ensures all the scrubbers and mains being kept full of gas a little above the atmospheric pressure; air cannot enter to form an explosive mixture. A gas holder also shows the attendant whether a sufficiency of gas is being made, and its rise and fall can be used to regulate automatically the production of gas to suit a varying rate of consumption. For blow pipes and any work where the gas must be burnt with air at pressure it is certainly important that the pressure of the gas, as well as that of the air, should be constant. With a blow pipe a considerable quantity of gas should be burnt with a comparatively small flame, to ensure a concentration of heat, and even with producer gas of good quality it is always more or less difficult to get a well-pointed sharp flame; it can only be done with a suitable blow pipe provided the gas pressure is steady. In this, as in many other cases, it is comparatively easy to make the gas; the real difficulty is to apply it properly, and it is unfortunate that this simple fact is so often overlooked or not understood. On the other hand, some manufacturers are most keen and intelligent; and, as one pleasing instance among many, I may mention the Hoffman Mfg. Co., which has to temper very exactly steel balls for bearings. These balls are fed mechanically and continuously, night and day, into rotating furnaces which are heated with producer gas burnt with air at pressure; there is a registering electric pyrometer, and when once a furnace has been started with the heat required it is left without attention. The whole system works automatically, and the pyrometer chart shows how closely the required temperature is maintained. It would, of course, be impossible to do this with ordinary fires, and it is satisfactory to know that it is economical.

The various kinds of heating work for which producer gas is used are too numerous to mention, but the following may be instanced to show the importance of this branch of work. Cooking and baking in hospitals and asylums; japanning and enameling; type founding; varnish making; melting in crucibles; cutting and finishing glass; heating tailors' irons in clothing factories, and laundry irons, calenders, etc.; gassing silk and cotton yarns; singeing textile fabrics; soldering biscuit and condensed milk tins, etc.; annealing, hardening, and tempering; boiling sugar and roasting coffee, cocoa, and other food products in factories. The applications of producer gas are numerous and varied, but in proportion to the immense amount of heating required in the various industries throughout the kingdom, I cannot help feeling that still more progress would have been made if manufacturers and others knew a little more about the subject technically. Often they do not seem to understand the treatment of gas or what can be done with it. For instance, it not infrequently happens that persons who have a gas plant to serve an engine think that they can take a branch pipe from the main to the engine for some heating work, and they then wonder why the flames jump, and why the result is unsatisfactory. In some cases they have condemned the gas when the only fault was their own want of knowledge. Not long ago complaint was made by an important firm in

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the north that the producer gas burnt well at first, and afterwards nearly went out. An expert was sent down specially, at considerable expense, to find that they were trying to burn the gas in a closed chamber, and had neglected to provide for the removal of the products of combustion, so that the gas was stifled. On another occasion there was a proposal to heat a muffle furnace with producer gas, and the objection raised was that the gas would not burn until the furnace was heated up to 700 deg. Cent., and that to do this there must be a coal fire. In these days of technical instruction one hardly expects to meet with such nonsense as this.

Undoubtedly the greatest development in the use of producer gas has been with gas engines, especially during the last few years. A gas engine was worked for the first time with producer gas in 1879, the gas being made in a plant I devised; it was a small engine, and developed only 3¼ B. H. P. It consumed about five times more producer gas than it would have consumed of ordinary town gas, although theoretically the comparative consumption of the two gases should have been as 4 : 1. This showed that the weaker gas was not used to the best advantage. At the present time its treatment is better understood, and many important modifications have been made in gas engines. The calorific power of producer gas of this type remains about the same as in 1879, but now it is necessary to use only four volumes of it for one of ordinary town gas. On this point, therefore, theory and practice are now fairly in accord; and although it would be beyond the scope of this paper to discuss the improvements in the gas engine, I may say that, in large measure, they have been due to a better understanding of the thermodynamic problems involved. At first the makers of gas engines sought improvements almost exclusively in mechanical devices, and little attention was given to the behavior of different kinds of gas under the varying conditions of temperature and pressure in the cylinder before and after each explosion. We are chiefly indebted to our president, Mr. Dugald Clerk, for his investigation in this direction, and there are now many skilled workers who are giving close attention to this interesting and important subject.

Until the last few years the producer gas used for gas engines was generally made with a jet of steam at pressure which injected the air required, but sometimes air at pressure was forced into the producer by means of a fan or blower. The gas made in either of these ways leaves the producer at pressure, and is now generally known as "pressure" gas. In some of the early gas producers used for furnace work air was drawn into the producer by suction—notably in the case of the Siemens producer already referred to—and in recent years the idea of working the producer by suction, instead of by pressure, has been reverted to in connection with gas engines. As early as 1862 Dr. Jacques Arbos, of Barcelona, patented a combination of gas plant and gas engine, in which the latter drew gas direct from the producer, and as this was about the time that a good deal of attention was being given to the Siemens suction producer and furnace, it is not unlikely that he was inspired by this, and sought to apply the principle of suction from a gas engine. However, it was not a very practical arrangement, and there is no record of its having been actually used. The first to give effect to this idea in a practical way was M. Leon Benier, of Paris. His first patent was in 1891, and in the early plants he made the engine that had a suction pump at the side of the motor cylinder, which drew gas from the producer and forced it into the cylinder. The combination was carefully tested by Prof. Aime Witz, but the results were not satisfactory, and the next step of importance was to do away with the pump, and to use the suction of the engine (on the outstroke of the piston) to draw gas from the producer. Various other modifications in detail, especially as to the way of producing steam, have since been introduced by different makers, and what is known as a "suction plant" is now extensively used. I wish, however, to emphasize the fact that the chemical reactions on which the production of gas made with the steam and air depends are identical in all types of producers. On several occasions manufacturers have spoken to me as though suction-gas were some new discovery; and they seemed rather surprised, if not disappointed, to learn that it was but an old friend in a new dress. I have even seen some engineers' specifications in which the strange and rather contradictory term "pressure suction gas" is used. The names "pressure" and "suction" gas are not ideal, they are not scientific, but they are conventional terms which have been generally adopted to convey definite meanings; and it will only lead to confusion if these meanings are misunderstood or the terms are wrongly used.

The calorific power of pressure gas made with a jet of superheated steam is usually considerably higher than that of suction gas. In the former the percentages of hydrogen and carbon monoxide are higher, while the percentage of nitrogen is lower; and if the gas is to be used for heating purposes in small burners, or in blow pipes, it is better to use pressure gas than suction gas. In many operations it would, in fact, be almost impossible to use suction gas, as after the gas had been washed and cooled its flame temperature would be too low, especially if air at pressure were used to burn the gas. But for driving gas engines, suction gas is extensively used with excellent results, provided the engines are properly adjusted for it. Suction gas contains a smaller percentage of combustible gas than pressure gas usually contains; and although it requires less air for its combustion, the loss from fluid friction is greater, and for these reasons an engine worked by suction gas develops a lower maximum power than it would with pressure gas. This loss in maximum power is not important in a small or moderate sized engine, but it is more serious in an engine of, say, 200 H. P. or upwards, and for a given power larger cylinders must be used for suction gas. On the other hand, the fuel consumption in a complete pressure gas plant with an independent boiler is higher than in a suction plant, and its heat efficiency is necessarily lower than that of a suction plant which produces its own steam. If, however, the steam for the pressure plant is raised by the sensible heat of the gas produced, as is often done, the fuel consumption and the heat efficiencies of the pressure and suction plants are alike. We may therefore assume that under these conditions the heat liberated by the exothermic reactions is recovered in each case to about the same extent by the endothermic reactions.

In considering the two types of plant, our general conclusions may be as follows: A suction plant has certain practical advantages—it costs less and occupies a smaller ground space, but the gas made in it is not so strong as in the older form of pressure plant, and in some cases this advantage of the latter is important. The fuel consumption per horsepower hour, and the labor required, are about the same in both types of plant, provided the steam required is raised

(Continued on page 34.)

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THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

Published every Thursday by

The Penton Publishing Co.
CLEVELAND.

BOSTON.....73-74 Journal Bldg.
BUFFALO.....932 Ellicott Sq.
CHICAGO.....1328 Monadnock Blk.
CINCINNATI.....First National Bank Bldg.
NEW YORK.....1005 West Street Bldg.
PITTSBURG.....510 Park Bldg.
SEATTLE.....302 Pioneer Bldg.

Correspondence on Marine Engineering, Ship Building and Shipping Subjects Solicited.

Subscription, U. S. and Mexico, $3.00 per annum. Canada, $4.00. Foreign, $4.50. Subscribers can have addresses changed at will.

Change of advertising copy must reach this office on Thursday preceding date of publication.

The Cleveland News Co. will supply the trade with the MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Company, Breams Building, Chancery Lane, London, E. C., England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

October 15, 1908.

THE ISTHMIAN CANAL CARRYING.

There have been 24 American steamships laid up idle in New York harbor and other vessels at other ports on the coast throughout the past summer, when foreign steamships have been steadily employed by the United States government in carrying supplies and materials for the construction of the Panama canal. These foreign ships, because of the low-wage rate at which they are built and operated, have been able to underbid American vessels for the canal business, exactly as foreign factories, with operatives working for 60 or 75 cents a day, would be able to underbid American factories in the American market but for the protective tariff on imported merchandise. Congress, by a joint resolution, has insisted that none but American materials and supplies shall be used in the construction of the canal, unless the prices asked are excessive and unreasonable. And Congress and the executive department insist that none but American citizens shall be employed on the canal in the capacity of engineers, clerks, foremen or skilled mechanics. All this has the result of making the canal cost more money, but it is regarded as consistent with the protective principle, and as demanded out of decent consideration for American interests.

But a different idea has been applied to the transportation of these supplies and materials. This has been given on the free trade policy to the lowest bidder, who has usually been the cheap-wage foreigner. Senator Frye, of Maine, introduced last winter a resolution giving American ship owners the same protection and encouragement in the building of the canal as Congress had already provided for American manufacturers. This resolution was passed by the senate on March 13, 1908, and on April 20, 1908, was favorably reported as follows to the house of representatives:

JOINT RESOLUTION.

To provide for the transportation by sea of material and equipment for use in the construction of the Panama Canal.

Resolved by the Senate and House of Representatives of the United States of America, in Congress assembled, That in any contract hereafter made, transportation by sea of material and equipment from the United States for use in the construction of the Panama canal shall be restricted to vessels owned by the United States or by the Panama Railroad Co. or to vessels of the United States chartered by the United States or by the Panama Railroad Co., or to vessels of the United States tendered by the lowest responsible bidder, unless the President shall in any case deem the bids or tenders therefor to be extortionate or unreasonable. Provided, That this resolution shall not apply to any foreign steamship chartered by the Panama Railroad Co. to take the place of any of the present fleet destroyed or undergoing repairs, after the President shall have been satisfied that a suitable vessel of the United States could not have been chartered on reasonable terms for that purpose. And provided, further, That the Isthmian canal commission is hereby authorized to purchase or charter and operate vessels of the United States for the transportation of material and equipment for the use of the canal, employes on and mails for said canal, whenever in the opinion of the President the public interests will be best so served.

Sec. 2. That in every such contract the party, or parties, bidding on the same shall be authorized to submit bids to deliver said material and equipment, in the alternative, either—

First. On docks within reach of the ship's tackle at seaports of the United States named by the bidder.

Second. On docks, at the option of the bidder, at Colon or La Boca (1) in ships of American register; (2) in ships of foreign register.

Owners of the American steamships now lying idle at New York and of other unemployed craft on the Atlantic and Pacific seaboard are moving to urge the leaders of the house to consider and pass this resolution as soon as possible after congress reassembles next December. They are pointing out that as things are now the government practices one policy, the protective policy, toward manufacturers, miners, farmers, lumbermen and other Americans furnishing material and equipment for the canal, and the opposite policy of free trade toward American ship owners and seamen. These American shipping men will ask congress why this discrimination against the American flag on the ocean should have been allowed in the past and should be tolerated in the future. President Roosevelt and Judge Taft are known to favor the passage of this resolution, giving American ships the same preference now bestowed on American factories, farms, mines and forests.

The Gulf Coast Inland Waterway Association has been organized at Mobile, Ala., to further the navigable interests of the gulf.

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AMERICAN SHIP BUILDING CO.'S ANNUAL MEETING.

The annual meeting of the American Ship Building Co., of Cleveland, was held at Jersey City, N. J., yesterday.

In the election of officers and directors but one change was made, W. C. C. Carpenter, of New York, replacing Frank W. Hart, of Cleveland, on the board of directors. The election of Mr. Carpenter furnishes a representative to the New York interests which have lately purchased quite largely of the company's stock.

The officers and directors for the ensuing year are therefore as follows:

J. C. Wallace, president; R. C. Wetmore, vice president and treasurer; Ora J. Fish, secretary; W. L. Brown, Chicago, Ill., president of the board. Directors, H. H. Porter Jr., Chicago, Ill.; Robert Wallace, Cleveland; W. C. McMillin, Detroit; H. M. Hanna, R. L. Ireland, Cleveland; Andrew M. Joys, Milwaukee; J. A. McGean, New York; A. B. Wolvin, Duluth; L. M. Bowers, Binghamton, N. Y.; W. C. C. Carpenter, New York; Edward Smith, Cleveland.

Following is the ninth annual report to the stockholders:

The close of our fiscal year finds the company with little new business on its books. We have however completed a number of large vessels during the past year, and done a fairly good business in our various repair yards and dry docks.

CAPITAL STOCK.

Remains unchanged from last year, viz:

AUTHORIZED—	
Preferred	$15,000,000
Common	15,000,000
Total	$30,000,000
ISSUED—	
Preferred	$ 7,900,000
Common	7,600,000
Total	$15,500,000

DIVIDENDS.

Regular quarterly dividends of 1¼ per cent have been paid on the preferred stock, and four quarterly dividends of 1 per cent, and an extra dividend of 2 per cent have been paid on the common stock.

PROPERTY OWNED AND CONTROLLED.

CLEVELAND, OHIO.
Boiler Shops — Construction Yard
Three Dry Docks — Machine Shops
Foundry

LORAIN, OHIO.
Construction Yard — Machine Shop
Two Dry Docks

DETROIT, MICH.
Machine Shops — Brass Works
Boiler Shops — Three Dry Docks
Foundry

WYANDOTTE, MICH.
Construction Yard — Machine Shops

SUPERIOR, WIS.
Construction Yard — Two Dry Docks
Machine Shop

CHICAGO, ILL.
Two Construction Yards—Three Dry Docks
Two Machine Shops

MILWAUKEE, WIS.
Machine Shop — Two Dry Docks

BUFFALO, N. Y.
Construction Yard — Four Dry Docks
Machine Shop

WEST BAY CITY, MICH.
Construction Yard — Machine Shop

CONDITION OF THE PROPERTY.

Repairs have been made on the various properties so that they have been kept up to their usual standard of efficiency.

Work is now under way on enlarging the small dry dock at the Superior plant, to make it the same size as the other dock.

A new boiler shop building is being erected at the Lorain plant, and should be in operation about Jan. 1.

A contract has been let for one of the largest dry docks on the lakes, to be built at our Buffalo plant, which should be completed inside of one year.

There have been no incumberances of any kind placed upon the property during the past year.

VESSELS BUILT.

Plants—	Vessels built.	Carrying capacity, net tons.
Superior	2	15,000
Lorain	8	62,000
Cleveland	3	19,000
Detroit	4	32,000
Bay City	2	19,000
Buffalo	2	3,000
Chicago	2	18,000
Total	23	168,000

Carrying capacity is based on 19 ft. draught.

SUMMARY AND PROSPECTS.

The company has built and completed 23 vessels during its fiscal year, and now has under contract four vessels. Owing to the general depression in business all over the country, which has been felt very keenly in all branches of the iron and steel industry, and especially so in the lake carrying trade, which depends largely upon the movement of coal and ore for its business, the outlook is not at all bright for any great amount of bulk freight vessel construction this year. The passenger business all over the lakes has been very good, and there is some talk of new construction in this direction.

Your president desires to thank the officers of the company, directors and stockholders for their continued hearty co-operation and most efficient support.

The condensed balance sheet herewith shows the condition of the company.

Respectfully submitted,
W. L. BROWN,
Chairman of the Board.
JAS. C. WALLACE,
President.

ANNUAL STATEMENT.

RESOURCES.

Plants and property		$17,182,021.33
Additions to plants, 1907-8		487,819.64
Material on hand (market value)		589,862.90
Accounts and bill's receivable		3,582,872.85
Due us on bonds sold		596,610.00
Due us on construction contracts		206,130.41
Cash		1,195,481.68
Total		$23,840,798.81

LIABILITIES.

Capital stock preferred	$7,900,000.00	
Capital stock common	7,600,000.00	
		15,500,000.00
Accounts and bills payable		1,673,668.89
Reserve for maintenance	500,000.00	
Reserve for fire insurance	154,572.78	
		654,572.78
Earnings	$1,713,907.86	
Less:		
Dividends, preferred	$ 553,000.00	
Depreciation and maintenance	387,961.08	
	940,961.08	
	$ 772,946.78	
Balance, June 30, 1907	$5,695,610.36	
Less common dividends, 6 per cent	456,000.00	
	5,239,610.36	
Working capital, June 30, 1908		6,012,557.14
		$23,840,798.81

President Keefe, of the Longshoremen's Association and W. H. Teare, president of the Lumber Carriers' Association, were in conference in Cleveland on Wednesday of this week. The agreement made last spring for loading lumber at the upper lake ports for this season was extended to Jan. 1, 1910. No changes were made in the agreement and the wages will be the same as they have been for the past two seasons. The extension affects 42 locals. The same arrangement will probably be made for unloading lumber at the receiving ports.

The steamer George H. Russel, of the Gilchrist fleet, upbound with coal, while off Manitou Island, Lake Superior, broke her outboard shaft at the stern post and lost the end of the shaft and her wheel. She was picked up by the steamer William A. Hawgood and towed to Ashland where she will discharge her cargo. Later she will be towed to Duluth for repairs.

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ADHESIVE ATTRACTION.

Editor of Question Dept., MARINE REVIEW:

I would like a more extended explanation on the following question than you have thus far given. "What is adhesive attraction, what is its cause and effect?" I have been following your lessons with a great deal of interest, and congratulate you on the extreme clearness of your explanations. I have had no reason to ask a question till now, your instructions having covered everything so thoroughly. I presume that my question will be dwelt upon again and at some length before you are through with this subject, but I am

Anxiously yours,

A MASTER.

Chicago, Ill.

Answer. — Adhesive attraction, or rather disturbance, as its name implies, is the quality of adhering or sticking. When a ship is swung hurriedly for deviation, and her head is not allowed to remain for more than a minute or two on any point before the observation for deviation is made, there is a temporary disturbance of the compass needle due to the fact that the induced magnetism of soft iron from the earth's force has not had sufficient time to part with the amount acquired while the ship's head lay in some other direction for a longer time. It takes some qualities of soft iron a greater or less time to gain and lose this induced or temporary magnetism than it does others, hence, in the process of swinging if the ship's head is not held on each of the observation points a sufficient time for this induced magnetism to gain or lose as it would if the ship's head were steady for a considerable length of time, say for 10 minutes, it is plain to be seen that the compass is not under the same influence it would be if the soft iron had time to go through with its natural changes.

The deviation due to this adhesive attraction is a species of the deviation caused by what is known as "retained" or "retentive" magnetism. When a vessel's head has been in one direction for a long time, either at a dock or on a long course, the hull becomes temporarily magnetized by the earth's inductive force, the temporary poles being developed in that part of the hull that was, at the time, coincident with the magnetic meridian. Sometimes this magnetism remains for some little time (several days, or even weeks, depending on how long the vessel's head was in the one direction) after the ship's head has been changed, hence, the name, "retentive." It then gives way to magnetism induced in a new direction according to the change of course. The temporary effect of retentive magnetism upon the compass is to cause it to deviate invariably in the direction of the last course, hence, if a vessel has been heading NE for several days or longer, and her course be changed to east it will be found that the true deviation previously existing on the point east is increased if it had been westerly and decreased if it had been easterly. In this case it would be necessary to steer to the south of east to make good an east course. If the course had been shifted to the left or north'ard of NE, the above conditions would be reversed—easterly deviation would be increased and westerly decreased. The error in the normal deviations due to this cause frequently amounts to a point and upwards.

With the ship heading NE the magnetic meridian coincided with a point on the port bow and starboard quarter, in other words, new magnetic poles were developed at these points, the north pole at the bow and the south pole on the quarter. Now, if the vessel's course was shifted to the east'ard of NE, say east, the north pole on the port bow would repel, the north end of the compass needle would be repelled to the left, or toward the last course, or the effect would be the same thing as westerly deviation. With the ship heading east the direction of the port bow is about NE, hence the port bow, or N-pole, is between ship's head and the compass needle. Supposing the ship's head had been changed to north under the same conditions, what would be the effect? The port bow would now be to the right hand of the compass needle, and as the effect is a repulsion, the needle is driven to the right, or toward the last course, NE being the course in question. Just bear in mind that the effects of retained magnetism is to draw toward the course the ship was heading on to produce it. Some hulls are more affected than others and do not part with it as quickly.

QUESTIONS FOR MASTERS AND MATES—No. 15.

220. Is it possible to have a magnet with only one pole?

221. Is the magnetism at the two ends of every magnet equal?

222. How could you determine (with compass and magnet) whether they were or not?

223. How could you determine the neutral line of a magnet?

224. Is the neutral line of a magnet always at the center of a magnet?

225. How do shocks cause and destroy magnetism?

226. How could you tell a good compass?

227. If you were to purchase a new compass what tests would you subject it to?

228. Are the magnetic poles of the earth points or areas?

229. How could you determine the location of the north magnetic pole?

230. Does the dipping needle show the same amount of inclination over the whole area denominated the magnetic pole, or is it just a spot where the dip is greatest?

231. What was the greatest amount of dip discovered?

232. Is the theory of magnetism identical with the earth's magnetism; that is, does the theory always prove in practice? Name one case where the two differ.

233. What is meant by the amplitude of arc?

234. What is the amplitude of arc from N to NNE?

ANSWERS TO QUESTIONS FOR MASTERS AND MATES—No. 15

220. No.

221. Yes, if properly magnetized, iron being homogeneous and symmetrical.

222. By holding one pole of the magnet at a certain distance from a compass needle and noting how far it attracts or repels the needle, then place the opposite pole of the magnet at a like distance from the compass and if both poles are equal the compass card will be moved an equal amount.

223. Find the point of no magnetic force.

224. Always at or near the center.

225. The position of the molecules composing the magnet are deranged and do not bear the same relation to each other as before.

226. Subjecting it to several tests.

227. Test for magnetic moment, directive power and sensibility, see that the lubber points were properly placed, magnets truly in line on the card and examine the graduations of the card and general workmanship.

228. Areas.

229. By finding the point of greatest dip. Should be 90°.

230. Over a considerable area.

231. Lacking a few minutes of 90 degrees, by Sir John Ross in 1831.

232. The theory does not always prove in practice. In an artificial magnet the magnetism in each pole is equal

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and will show 90 degrees of dip. In the earth's magnetism, no dip of 90 degrees has yet been found. The poles of an artificial magnet are diametrically opposite each other; the poles of the earth's magnetism are not. The magnetism in the earth also differs from that of a theoretical magnet in that it is subject to so many irregularities due to local influences and the lack of homogeneity.

233. The horizontal measurement of the angle of arc.

234. 22° 30′.

AROUND THE GREAT LAKES.

The steamer Mary C. Elphicke ran aground in the outer harbor at Buffalo last week, but was released without injury.

The steamer William Livingstone grounded at the entrance to Conneaut harbor last week, owing to unusually low water.

The steamer Gilchrist which went aground in the dyke, blocking the Middle Neebish channel, was released after a portion of her cargo had been lightered. The Gilchrist struck in the same spot that the steamer Edwin H. Ohl grounded on earlier in the week. It is claimed that the obstruction is a ridge that was left by the drill boats. The attention of Col. Townsend, government engineer, has been directed to it, and steps will be taken to remove the obstruction at once.

The work of sinking the sections of the Michigan Central tunnel is a little more than half way across the Detroit river, the sixth of the ten sections being ready to go down.

The steamer Australia which left Buffalo last Thursday night, had to put into Erie to take the chief engineer John Radford, to the hospital. It is supposed that he has appendicitis.

The Rutland Transit Co.'s steamer Wm. H. Averill while entering Chicago river with a load of package freight, splintered her bow in colliding with the State street bridge.

Milwaukee's harbor entrance will be widened 50 ft. within a year. Work will begin next spring and the job will be finished before cold weather. It will be done by the government engineer with the money remaining of the appropriation made for improving Milwaukee harbor. A new concrete pier will be built south of the one which now forms the south boundary of the entrance. It will be 1,600 ft. long.

The work of pumping out the great cofferdam on the second section of the new Livingstone channel at the mouth of the Detroit river is progressing rapidly and it is expected that the cofferdam will be drained this week.

President Livingstone of the Lake Carriers' Association received the following dispatch from Sault Ste. Marie last week: "The new channel through Vidal shoal to the Canadian lock will be opened at 9 o'clock Oct. 12, and the buoys moved to their new positions; also the new temporary range lights will be established 250 ft. north of the present range, showing a red light; a derrick scow will be at work on the north side of the new cut for a few days but will move out of the way of approaching vessels if necessary."

The steamer Sonora, which went on the rocks near Harbor Beach, had 48 damaged plates and was repaired at the Cleveland yard of the American Ship Building Co.

The steamer H. A. Berwind, which struck an obstruction at the entrance to Conneaut harbor, was repaired at Toledo, having 15 damaged plates.

Tenders have been asked for dredging of the channel basin at the mouth of the Mission river at Fort William and for the deepening of the Kaministiquia river at the same place.

Examination of the stern of the steamer John Duncan, damaged by her barge ramming her at Bar Point, shows that her stern bearing was gone. She was taken to Detroit for repairs.

The steamer Midland Prince, upbound, loaded, struck an obstruction at the dyke in the Middle Neebish channel this week, puncturing a bottom plate and filling her forward compartments with water.

The government engineer's department in conjunction with the Pittsburg & Conneaut Dock Co., have swept the channel at Conneaut where the steamer Berwind was reported to have struck an obstruction and found several shoal spots with about 20 ft. 5 in. of water over them.

All the upper works, including cabin, smoke stack and derrick, were swept off the sand carrier Junior by the swing of the Rush street bridge in Chicago river this week.

The lighter Reliance, which is stationed at the Sault, has been very busy of late. She took 65,000 bu. of corn off the steamer Arthur Orr and reloaded the lightered cargo, handling the 130,000 bu. in 44½ hours. The Orr was ashore at Bois Blanc Island in the straits. She took 2,000 tons of ore off the steamer Lyman C. Smith and she also took 1,500 tons of ore off the barge Bell, which was aground at the head of the West Neebish. The lighter worked on the steamers Ohl and Gilchrist which were aground at the dyke.

The steamer Lyman C. Smith, which struck the pier at the entrance to the Canadian canal at the Sault, has 15 damaged plates. She is being repaired at Toledo.

The steamer Frontenac, which went ashore on Persian Island, has 38 damaged plates. She is undergoing repairs at Cleveland.

The Great Lakes Engineering Works has completed repairs on the steamer Neepawah which has been in dry dock for the past three weeks.

Repairs on the steamer W. G. Pollock have been completed at the Cleveland yard of the American Ship Building Co.

Sherwood Kinyon, of St. Clair, who has been mate of the steamer Henry B. Smith for the past two years, has been appointed master of the steamer J. M. Jenks.

The keel has been laid at the Ecorse yard of the Great Lakes Engineering Works of the first of the two ships building for John J. Boland, of Buffalo. Both vessels will be ready by the opening of navigation 1909.

Repairs have been completed upon the steamer Maunaloa at Lorain.

Civil service examination will be held in the office of the lighthouse inspector, 405 Postoffice building, Detroit, Michigan, on Oct. 20, 1908, for the position of master on board light vessels, lighthouse service. Blank forms, application for examination, may be had on application to this office.

PACIFIC COAST NOTES.

Office of the MARINE REVIEW,
302 Pioneer Building,
Seattle, Wash., Oct. 9.

Tariff sheets have been issued by several steamship companies operating between Pacific coast ports and the orient showing the proportionate freight rates which will be charged by the ocean lines carrying through freight from the east. The new rates will be collected from Oct. 1 until such time as it may be deemed necessary to revise the list. Wheat and flour will be carried at the old rate and no change of consequence is made in the lumber tariff. Canned goods will go at the old rate; $7.00 a ton will be charged for hops.

The early morning of Oct. 2 witnessed one of the severest gales that has visited the Pacific coast for many days. The wind was general along the coast and extended from California to southern Alaska, but was inclined to be more severe in the north. Consider-

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able damage to shipping resulted. A number of small craft were beached and wrecked. At San Francisco the steamer Northland which started for Portland was compelled to return, having broken a steam pipe while fighting the storm. At Seattle the British bark Kildalton dragged her mooring buoy and with her jibboom raked the rail and house of the Pacific Coast Steamship Co.'s steamer Montara which was lying near. Libel papers were served on the Kildalton. Off West Seattle a boom of creosoted piles worth $500 and owned by the Northern Pacific railway broke loose but later were rescued near Four-mile rock.

Owing to a navy department regulation which forbids the officials of any yard from increasing their labor force during the 60 days prior to a national election work is being delayed at the Puget Sound navy yard, Bremerton, Wash. The most important job affected is the $100,000 repairs to the boilers and engines of the cruiser St. Louis. The completion of this work will be delayed about two months. Officials of the yard have repeatedly asked the authorities at Washington for permission to increase their force of workmen, but without success.

The contract for building two steel floats for harbor buoys has been awarded by the Seattle board of public works to the Moran Co. for $3,000.

Work on the main boilers of the new Seattle fireboat is reported to be 20 per cent completed. The work on the engines is also well advanced. The Puget Sound Ship Building Co., which has the contract for the hull, has not yet started work. The boat is to be finished within 300 working days from the date of the contract.

The gunboat Princeton, which is to go into commission shortly, was placed in the drydock at the navy yard, Puget Sound, Sept. 30, for examination and minor repairs. She will be out of the dock in a few days. The Princeton is to be sent to the great lakes by way of Cape Horn.

It is not thought that any definite decision will be made by government authorities regarding the proposed purchase of the Boston Steamship Co.'s 10,000-ton liners Shawmut and Tremont until after election. The big liners were formerly engaged in regular freight and passenger service between Puget Sound and the far east, but since the demoralization of Pacific coast over ocean trade by the presence of so many tramp colliers brought to this coast with navy department coal, they have been unable to operate except at a heavy loss. They have been lying idle in Seattle harbor for many weeks.

At the trial trip of the new Canadian Pacific twin screw passenger steamer Princess Charlotte, built by the Fairfield Ship Building & Engineering Co. of Govan, Scotland, for service between Victoria and Seattle, alternating with the Princess Victoria, a mean speed of 20 knots an hour was easily maintained with a good margin on a six-hour run.

A contract has been closed by the United Wireless Telegraph Co. with the owners of the steamship Indianapolis operating between Seattle and Tacoma, for installation of wireless apparatus on their steamer.

The steamers North Star and Boneta, owned by the White Star Navigation Co. and operated by the Red Collar Line of Coeur d' Alene, Idaho, betwen Coeur d'Alene and St. Joe on the St. Joe river, were burned to the water's edge while lying at the dock at St. Joe, Idaho, Oct. 5. The loss is $35,000 exclusive of $15,000 cargo of general freight. The owners have not decided whether to rebuild or not.

The licenses of both Capt. A. N. McAlpine, of the Chippewa, and Capt. Henry Henrickson, of the Sentinel, have been suspended for 30 days by the local inspectors at Seattle as a result of the inquiry into the collision between the two steamers in Elliot Bay, Sept. 12.

ATLANTIC COAST NOTES.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

The winter sailing schedules of the various trans-Atlantic lines are now being issued, as are also announcements of certain changes in sailing dates to go in operation next spring. According to the new sailing list of the Cunard Line the Saturday sailings from New York will terminate with the departure of the Caronia on Oct. 17, to resume on April 3 with the sailing of the Umbria from Liverpool. The service now going into force will be performed by the Lusitania, Campania and Lucania, with the Etruria and Umbria as reserve ships.

The White Star Line has announced a change in the sailing days on the Liverpool service of the company. After October 24 the sailings in this service from New York will take place on Saturdays, the Liverpool sailings on Fridays. The Wednesday sailings of the liners in the Southampton service remain unchanged.

The Hamburg-American Line express steamers will sail from New York next spring on Saturday, the sailing day at present being Thursdays. The company announces the placing in service at that time of the two new steamers Cleveland and Cincinnati, vessels of 18,000 tons. The slower vessels of the line will sail from New York Wednesdays instead of Saturdays.

The new institute for seamen, situated at 507 West street, New York City, was dedicated and formally opened on Oct. 7. The building, a magnificent edifice of brick and stone, having all the appurtenances of an up-to-date club, has been erected by the American Seamen's Friend Society and is without doubt the largest and most handsome structure of its kind in the world. In addition to separate sitting rooms for officers (engine and deck departments), stewards and stewardesses, there are billiard and other recreation rooms, writing rooms, parlors and sitting rooms. There is accommodation for 156 seamen, each with a separate room, and 11 officers. The building was erected at a cost of $325,000.

The fact that wrecking companies are unwilling to take the contract to refloat the United States cruiser Yankee leads to the belief that efforts in this direction are considered useless. The Yankee, ashore on Hen and Chickens shoals, has suffered considerably from the heavy weather of the past week, and in the opinion of naval experts will soon be a total wreck. Several unsuccessful attempts to get the cruiser afloat were made during the past week by the fleet of naval vessels and wrecking steamers. The cost of operations to date is considerably more than $100,000.

The United Fruit Co. announces that the steamers Cartago, Parismino and Heredia, of 5,000 tons each, and specially constructed for service in the tropics, will henceforth be in service between New Orleans and Colon, Panama. Passenger service between Boston and Jamaica has been discontinued.

The Compagnie Generale Trans-Atlantique has inaugurated a series of monthly sailings between New Orleans and Havre, the first sailing being that of the Saint Laurrente, which left New Orleans for Havre on Oct. 9. The steamers have been installed especially for

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third class passengers, though in some cases first class accommodation can be had. Freight will also be handled. Stops will be made during the trip at Corruna, Santa Cruz de la Palma, Teneriffe and Havana, and the time taken between ports in France and this country will be about 18 days.

G. P. Hunter, head of the firm of Swan & Hunter, builders of the Mauretania, arrived at New York on the Lusitania last week and intends spending several weeks in this country. The Mauretania, according to Mr. Hunter, will go into drydock at Birkenhead, where the new port high-pressure strut will be placed in position. The Mauretania will be out of service during the months of November and December.

The captain and five of the crew of the British schooner Sirocco, who were supposed to have been lost when the vessel was wrecked off the coast of Florida on Oct. 1, were landed at Boston on Monday by the fruit steamer Horatius. Two members of the crew were landed at Newport News by the British steamer Tiverton on Saturday, and before the arrival of the Horatius at Boston were supposed to be the only survivors. On both occasions the men were picked up on drifting wreckage and were in a very exhausted condition. The Sirocco was bound from Brunswick, Ga., to Abaco, in the Bahamas, and was wrecked on Mantanillo Reef in a tropical hurricane.

The wrecking steamer Rescue returned to Norfolk, Va., on Monday after an unsuccessful attempt to locate the disabled three-masted British schooner Earl of Aberdeen. The Aberdeen on Monday was 14 days out from Turk's Island with salt for Providence, R. I., and was helpless somewhere off the Carolina coast through the loss of her rudder. The Rescue is understood to be eventually able to locate and bring in the disabled vessel.

The lighthouse flotilla, bound from Tompkinsville, S. I., for the Pacific, left San Juan, Porto Rico, on Monday for St. Lucia, where the vessels will coal and proceed to Pernambuco. The fleet of lightships and tenders was built by the New York Ship Building Co., at Camden.

The United States local inspectors of steam vessels on Monday began an investigation into the collision between the steamboat City of Chester and the tug J. S. W. Holton, which happened in the Delaware river off Bellevue on the night of Sept. 11, when two men lost their lives. Outside of the taking of testimony of material witnesses, no other action was taken, the conclusion of the inspectors to be announced next week. Representatives of both vessels were present.

The steamship Washtenaw, from New York for San Francisco, arrived at Montevideo on Oct. 11, having in tow the disabled British ship Leicester Castle, for Pisagua from Cardiff, which she had picked up disabled at sea. The Leicester Castle had on board a cargo of coal.

Capt. Neergard, of the Danish steamer Astoria, which arrived at Philadelphia on Monday from Rotterdam, reports having passed a large iceberg on Oct. 5 in latitude 45.37, longitude 47.51. An iceberg was passed by the German steamship Barbarossa, which arrived at New York from Bremen last week. It was about 70 ft. in height and 150 in length, and was surrounded by several smaller bergs.

A new record of 4 days, 18 hours and 40 minutes from New York to Galveston, Tex., was made by the new Mallory Line steamer Brazos, which was reported at Bolier Light, off Galveston bar, on Oct. 8, on her maiden voyage south. She covered the distance of 2,000 miles at an average speed of 16½ knots.

CONTRACT FOR NEW STEAMER.

Charles B. Calder, general manager of the Toledo Ship Building Co., closed contract with Rufus P. Ranney, of Cleveland, this week for a bulk freighter of 7,500 tons capacity to come out next spring. The new steamer will be 460 ft. over all, 440 ft. keel, 56 ft. beam and 28 ft. deep. The new steamer will have triple-expansion engines with cylinders 22½, 36 and 60 in. diameter by 42-in. stroke, supplied with steam from two Scotch boilers, 14½ ft. diameter and 11½ ft. long. The new steamer will be managed by Boland & Cornelius, of Buffalo, and will be sailed by Capt. George A. Symes, of Cleveland.

The lower end of the new easterly channel at Bar Point, Detroit river, lying in Canadian waters, has been completed for the full width of 800 ft., and President Livingstone of the Lake Carriers' Association has arranged with the Canadian marine department to place two acetylene gas buoys at the entrance to the channel from Lake Erie.

LAKES TO THE GULF DEEP WATERWAYS ASSOCIATION.

Unusual interest was lent to the annual meeting of the Lakes to the Gulf Deep Waterways Association at Chicago last week by the joint presence of Wm. H. Taft, the Republican candidate for president of the United States, and Wm. J. Bryan, the Democratic candidate for president, at the banquet. Both candidates spoke, but neither in any way referred to the campaign.

The convention was the most successful that the association has ever held. Congressman Wm. Lorimer, the founder of the association, gave an address on history of the organization. His reception was practically an ovation.

All the old officers were re-elected with the exception of David R. Forgan, of Chicago, who was replaced as first vice president by E. S. Conway, of Chicago. The officers are as follows: President, William K. Kavanaugh, Missouri; first vice president, E. S. Conway, Illinois; second vice president, M. J. Sanders, Louisiana; third vice president, S. M. Neely, Tennessee; fourth vice president, J. L. Hebron, Mississippi; fifth vice president, Greenfield Quarles, Arkansas; secretary, William Saunders, Missouri; treasurer, George H. Monroe, Illinois; sergeant-at-arms, Thomas M. Hunter, Illinois.

All officers to be members of the board of governors.

Board of governors—John M. Parker, Louisiana; Judge William M. Kavanaugh, Arkansas; R. R. Borland, Illinois; James F. Smith, Missouri; James F. Buckner Jr., Kentucky; Drew Musser, Minnesota; Thomas Wilkerson, Iowa; John H. Moss, Wisconsin; Charles Scott, Mississippi; James S. Warren, Tennessee; J. W. Zevely, Oklahoma; A. L. Crocker, Minnesota; James S. M. Neil, Montana; Charles T. Madison, Oklahoma; W. R. Childs, Kansas; W. C. Lusk, South Dakota.

The resolutions adopted by the association, together with drafts of the principal addresses will appear in a later issue of THE REVIEW.

The steamer Alexis Thompson grounded at the entrance to Sheboygan harbor this week. She was released by the tug Reis, uninjured.

The Canadian barge Energy collided with the car ferry Ariel in the Detroit river on Tuesday of this week, smashing the cabin on the port side of the car ferry.

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VENTILATION AND SANITATION.*

BY A. E. BATTLE, INSTITUTE OF MARINE ENGINEERS.

Pure air is as essential for health at sea as on shore, and the various branches of sanitation require equally as much, in fact more study and attention on ship board than on land, owing to the confined spaces and peculiar and varying conditions.

The idea that sea air solves all hygienic difficulties, the apparent belief in its magical purifying properties, I am sorry to say, must be refuted as ridiculous and absurd, born only of human inclination to be contented with any and every conscience-quelling possibility, in the endeavors to obtain economy, yes, economy, so called, apparently at any costs.

The blind following by precedent, together with the fact that men still follow the sea calling, and perhaps the fact that public attention is not continually riveted upon individual vessels is possibly accountable for the lack of even an attempt, in most cases, at efficient sanitary arrangements (by sanitary arrangements, I mean the term in its broadest sense). In other cases money has been spent in purchasing and equipping desirable apparatus, but a want of care and knowledge on the part of the builders often results in frustrating the ends desired.

This lack of the combined knowledge of sanitary science together with that of the internal economy of all types of modern steamship, induces me to confine myself this evening to the subject of ventilation and heating, together with berthing arrangements on board ship.

It is surprising that more attention has not been paid to this subject, when it is considered what an exhaustive amount of literature has been written on ventilation ashore. This want of special knowledge is, therefore, my excuse for referring to the elementary principles of ventilation and practices ashore, as, may be, suggesting to the ever-fertile brain of the naval architect and marine engineer, possibilities of their application for marine purposes, or, at least, that as ventilation is so necessary ashore it is possible that those magical purifying properties of the ocean air may not have so beneficially affected, as apparently has been too frequently fondly imagined, the foul and polluted air the other side of even a very thin mild steel bulkhead.

*Read at the Engineering and Machinery Exhibition, Olympia, London, before the members of the Institute of Marine Engineers.

I must ask your indulgence if I repeat somewhat certain sections of my previous lecture: "Sanitation as Practiced in the Mercantile Marine," delivered in this hall last year.

Everybody will agree that, at least ashore, pure air is essential for health, together with equality of temperature, also that in certain occupations the matter of ventilation requires special attention and consideration. I would also venture to suggest that, for the safety of the public and their property, the berthing of officers and men on board ship should be such as will allow their taking healthy rest, and also that in such places where men are employed on watch, such as in the engine room, etc., ventilation should receive careful consideration. For to keep a watch of four hours in a close and heated atmosphere, where ventilation can best be described as nil, after sleeping in a badly ventilated and badly situated berth, requires considerable effort on the part of the officer in charge to keep from napping in his watch, for he is only human. And I venture to say that if such a case were investigated by unbiased mind, the verdict would be in favor of the unfortunate culprit, and a condemnation of the ventilation system.

We inhale in the course of 24 hours 480 cu. ft. of air per minute when at rest, and more than double this amount when at ordinary work. The process of our purification of the blood is outside the sphere of our present investigation, and if any of my hearers are not already acquainted with the same, it commends itself to your investigation. The form and type of air impurities, however, certainly demand attention.

The impurities of the air vary greatly with the local conditions. It is worthy of passing note that CO_2 when present in the atmosphere in excess of 0.04 per cent is considered an impurity, and that when present in the atmosphere in 0.06 per cent it indicates the permissible limit of air pollution in accordance with the best hygienic practice; 0.06 per cent of CO_2 is, therefore, termed the standard permissible impurity. Carbon dioxide is of itself harmless in quantities likely to be encountered in the atmosphere, but the fact that all increase of dangerous impurities is accompanied by a corresponding increase of CO_2 decided this selection.

On shipboard such a standard as the above might hold good in saloons and in some cabins; but I doubt whether, in the bunkers of a ship, or in the stokehold or engine room, the increase of dangerous impurities could be so indicated by the presence and quantity of CO_2.

The conditions of ventilation of a bunker are not, as a rule, the best. It would be of advantage if the bunker doors were open to allow an air current to pass up through the coal. I have here an apparatus consisting of a U tube filled with fine coal dust; it will be observed that when the air pressure is most slightly disturbed in the one tube by means of this India rubber ball the indicator at the other side shows clearly that the air current freely passes through the coal.

I cannot impress upon those in authority too forcibly the necessity of providing through wind current in bunkers, even if at a little discomfort to the berths in close proximity to the bunker hatch. For down there in the dull black bunker the conditions of working are, if anything, worse than a coal mine itself.

But confining myself for the present to such conditions as prevail in saloons and sleeping berths, the land rules may apply. It is estimated that to keep the standard of impurity of the atmosphere to within 0.06 per cent will require for each person 3,000 cu. ft. of air per hour. Upon this is based the deduction of the cubic space required per individual. Now, the space required is a matter dependent upon the facilities for changing the air, and providing the changes can be satisfactorily effected, the board of trade allowance of 72 cu. ft. per man might be termed a luxury. In fact a mere box would suffice as a sleeping compartment. But, unfortunately, the rate of air change is very limited, temperature playing no small part in this direction. Air traveling at 1½ ft. per second is not perceptible, and even at 2 to 3 ft., it cannot be said to cause a draft. This would perhaps suggest that all air should be heated in a system of marine ventilation, on account of the limited space and the consequently many changes required to maintain anything like a satisfactory standard of purity.

A change of air three times an hour is all that can be borne under ordinary conditions and with such conditions the space required per individual would be 1,000 cu. ft. The authorities have thought fit to allow Tommy Atkins when in barracks 600 cu. ft., and the common lodging house, where a considerable number of our firemen collect when ashore, 300 cu. ft. per man, and viewing the above facts, the basis of 72 cu. ft., as allowed by the Merchant Shipping Act, is surprising.

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It would be certainly interesting to know the field of research whereby it was discovered that men at sea could under certain conditions apparently be, shall we say, content, with such a limited space.

The usual method of deducting the air space required is of itself instructive and interesting, namely:

The amount of CO_2 given off by one person.

Possible maximum quantity of CO_2 —CO_2 in 1,000 cu. ft. of air = Air required per individual.

The rules for computing the air space on board ship is laid down in the board of trade instructions to surveyors, and can be broadly stated as the most that can be made of the floor space in square feet independent of its utility, divided by 12, providing always that the cubic capacity does not fall short of 72 cu. ft. per seaman after deduction has been made for certain encumbrances, such as hatches and ventilating trunks. For some reason, however, spaces occupied by bunks are not deducted.

It is a noteworthy fact that builders fit the maximum number of berths allowed by the board, independent of whether that number of crew are to be carried or not, and so greatly reduce the all-too-small air space accordingly. Perhaps it is to induce the owner to carry a larger crew, for we know that quite a number of owners realize that the Merchant Shipping Act complement of men is small, and for this great blessing, for it is a blessing, we who go down to the sea in ships are duly thankful. But why any berth should be a fixture, built in in such an immovable fashion, apparently on the same principle as the laws of the Medes and Persians, is a question perhaps the ship builder can best answer. Why cannot the great improvements effected ashore in this direction be adapted to ship requirements, and upon that basis I would suggest the following rules, in connection with ships' bunks, as a possible guide to health and cleanliness generally:

1st. All bunks should be constructed clear of the ships' side or bulkhead, to allow a free circulation of air.

2nd. They should be placed for preference against the inner bulkhead; that is, not against the ship side.

3rd. They should all be removable the framework of iron and wire springs substituted for the usual wood lathing. The sides or bunk boards not more than 8 inches deep. The foot and head boards to be carried to within 6 inches from the deck above. The minimum dimensions being 6 ft. 6 in. long by 2 ft. 3 in. broad. The bunk to be as much above the deck as possible.

The cubicle system of crew accommodation, however, is preferable, possessing more of the civilized element, and the class of men following the sea, who live forward, would undoubtedly improve if the conditions of living were more pleasant.

Stringent regulation should be enforced regarding fitting lockers under bunkers or obstructing the free circulation of air by stowing boxes and the like under bunks in both cabin and forecastle.

The farce of morning inspection of a ship by a commander ignorant of the elementary rules of sanitation, or a medical man who, with few exceptions, is ignorant of the internal economy of a modern vessel, generally results in discomfort only, and is productive of very little good.

The ordinary attempts at ventilation on board ship must, to use the mildest language, be termed ill directed, possibly from a combination of want of thought and want of special knowledge. Conformity to the letter of the Merchant Shipping Act with regard to ventilation, irrespective of the elementary principles governing the position of ventilators, etc., in many cases is all that one finds, and ventilators are more often so arranged as not only to be useless, but a source of annoyance when anything but the mildest weather is encountered. In some cases ventilators discharge directly over a bunk. The natural consequence being it is kept plugged up from below to prevent intolerable drafts. This arrangement is more often than not due to the absurd notion of sacrificing all for appearance on deck, a condition which must give way to utility and practical science as it did under compulsion, when the black smoking funnel found a place on the before spotless deck to lay smuts belched forth with clouds of black smoke, and covering with soot, masts, riggings, and sails alike.

Sir John Clarke, one of the leading authorities on hygiene, says: "Air, as it increases in temperature, or becomes loaded with watery vapors, has its weight diminished and ascends. Now the air in an inhabited apartment, being both heated and generally combined with a portion of watery vapors from respiration, etc., becomes specifically lighter, at the same time that it is vitiated, and rises to the roof. If it is given the means of escape it would be gradually forced out by an equal quantity of pure and more dense air entering from below, which in turn becomes heated and deteriorated, would in like manner ascend and make its escape, thus would a continual current of the air circulate without any trouble on our part. Unless provision be made for the escape of the ascending current of impure air, no admission of external air will secure proper ventilation."

This in compartments where the changes could be made without causing a draft would be highly desirable. But where it is considered that under natural conditions, air cannot be changed more than three times per hour without creating a draft, together with the following table (taken from a reliable source) of the rate of increase of impurities, it will be noticed, and I think forced home to any of my hearers who may have control of such things, that air in a small space becomes impure quicker than in a large.

RATIO OF IMPURITIES FOUND IN AIR PER HOUR.

	1,000 cu. ft.	500 cu. ft.
1 hour	0.12 per cent.	0.18 per cent.
4 hours	0.30 per cent.	0.54 per cent.
6 hours	0.42 per cent.	0.78 per cent.

One is apt to speculate after perusing the above. What would be in the figure for 72 cu. ft., under sea conditions where ventilation can generally be classified as non-existent?

It is obvious, therefore, that for vessels trading in cold climates, some system of heating the in-coming air is necessary to enable sufficient air changes to be effected without undue draft, and adequate heating at that.

Ventilation can be classed under two broad heads, natural and mechanical. Of the natural system for marine purposes, the Boyle patent air pump system certainly ranks high. The essential features of this system are the air pump ventilator (uptake), consisting of an arrangement of metal plates, at certain curves and angles, enclosed in a central chamber, from which the air is exhausted through a series of openings or slots, by the deflecting of the current of external air across the opening, and so creating an induced current in the ventilator and up the shaft and a down current ventilator of such a form, that the heads require no trimming, and a series of air shafts completes the system.

The makers claim for this system the following advantages:

1. Boyle's patent "air-pump" ven-

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tilator creates a continuous and powerful up-current when the vessel is lying in harbor or sailing. The latest patent has double the extracting power of the earlier forms, so that smaller ventilators may now be used, effecting not only a considerable reduction in the cost, but also a saving in space.

2. It is entirely free from down-draft.

3. It is perfectly water-tight, and may be kept in action during the stormiest weather.

4. It is a fixture, and never requires trimming, acting with equal efficiency with the wind blowing upon it from any point. Having no mechanical movement, it requires no attention and can never get out of order.

5. Boyle's patent downward ventilators send an abundant supply of fresh air below, and have in an equal degree advantages 3 and 4.

6. The exhaust and supply pipes may be concealed behind cornices, underneath seats, bunks, etc., and do not interfere with the structural arrangements or decorations of the saloons or state rooms.

7. Hot water or steam pipes may be placed within the supply shafts for the purpose of warming the air in cold weather. Ice boxes can be also fixed in the main shafts for cooling the air supply in hot weather.

8. The air is admitted into the saloons and state rooms through small vertical tubes, so that no draft is experienced, and the supply can be regulated as desired by means of a valve fixed in each tube.

9. The warm vitiated air is exhausted at the upper parts to where it naturally ascends, and the fresh air admitted in a vertical direction at the lower parts.

10. The ventilators can be readily adapted to existing arrangements and fittings on board ship.

11. Being waterproof they are most suitable for the ventilation of ships' tunnels.

The mechanical systems can be again subdivided into suction and propulsion. It has been said of the propulsion system that it causes stagnant places and consequently results in dirt and filth heaving up in out-of-the-way corners. A combined system of extraction and propulsion would possibly better meet the requirements. Steam jets have been used for creating a draught in ventilators, but the great noise and loss of water all worked against its success.

In connection with the ventilation of the engine room and stokehold a problem presents itself. Care should be taken, when natural draft methods are in use, to so arrange ventilators to prevent the air merely passing down the one and up the other. I would advocate a more efficient and satisfactory system of ventilating the bilges by extending both ventilators and uptakes down through the stokehold plates, the latter carrying some convenient exhaust pipe to assist in producing an up-draft. By this means a cool current of air would continuously pass under the plates, resulting in a cooling effect in the engine room, besides greatly preventing the discharge of bilge fumes, directly into the engine room, as is at present the case.

How often do we find ventilators in the stokehold and engine room so placed and constructed as to be useless. The fact that a right-angle bend in an air trunk reduces the delivery of air by one-half seems to be unknown, or, where merely a matter of fresh air is concerned, ignored. Many cases are to be found where the back of the engine room is supplied with ventilators, all too small under the best conditions, but rendered absolutely useless by two right-angled elbow bends.

The position of important ventilators on deck often sacrifices efficiency for appearance, and I am sorry to say the prevailing conditions are often intensified by the thoughtless persistence in erecting screens for a little personal comfort, smart appearance and the protection of a small portion of the snow-white deck, so dear to the heart of the chief officer.

In connection with the ventilation of an engine room and stokehold, therefore, I would suggest the following rules:

1. Use circular ventilating shafts instead of square, a circular section only offering seven-eighths of the resistance of a square of the same area.

2. Have shafts as short, smooth and air-tight as possible.

3. So place the up-takes and down-comers as to avoid air merely passing down the one and up the other.

4. Avoid angles and bends.

5. Fit cowls to both up-takes and down-comers.

6. Arrange ventilators and exhaust steam pipes so that the otherwise waste heat of radiation will assist ventilation.

7. Do not sacrifice appearance on deck for efficiency of ventilation.

CABINS AND BERTHING.

The general arrangements of cabins for the passengers, and especially those of the ship's company who have to make the vessel their home, now demands attention; by cabin I include the berths of the ship's company as well as those of the commanding officers.

Perhaps the most satisfactory position for berthing accommodation is in the alleyway, but, like everything else, it is not sufficient that a berth should be so placed; a little thought is also required to insure best arrangement of berths. And I say that the placing of berths adjoining engine room, galleys or stokehold, the berthing of firemen in the fiddleys and engineers in the engine room, is a practice which should be abandoned as both unsanitary, dangerous, and intolerable.

Berths in modern ships generally consigned to those whose duties are both responsible and trying, are still constructed where the temperature and impurity of the air from moisture, engine fumes, and bad ventilation are so great as to make even the necessary repose a matter of impossibility. Sleeping berths placed next to the galley, with bunks separated from the cooking stove by a thin steel bulkhead covered with thin match boarding, or what might be termed a special incubating apparatus for bugs and beetles, are also conditions which, in this twentieth century, do still exist and which have to be tolerated by those who enjoy "A life on the rolling wave."

In connection with berthing in alleyways, care should be taken to insure a through current of air at all times, and that cabin doors are as far as possible away from those of w. c., baths, engine room, and galley; parts can be then arranged opening into the alleyway with very beneficial results.

In this direction I would strongly advocate the introduction of a form of Tobin's tube as used ashore, fitted with a cotton air filter to remove any particles of dust from the entering air.

The practice of fitting sounding pipes to bilges and tanks in places used as berthing accommodation should decidedly be discontinued. Not only is there risk of contamination of the water due to animal and other impurities passing down the pipe, but badly-fitting plugs, as they usually are, allow foul gases to discharge directly into small berths. Badly constructed and badly-ventilated lavatories discharging impure air into blind alleyways, could be remedied. I am sure that those who are personally acquainted with the facts will agree that these conveniences at sea, especially those marked "For crew's use," are not of the best.

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Paint locker and bo'sun's stores next to forecastles and the use of the fore peak as a general store-room, with only an opening through the forecastle, covered over with a few planks, all indicate a want of thought on sanitary subjects on the part of those responsible for ships' construction. Whereas the common practice of fitting shelves and food lockers in forecastles, where one watch or the other are always sleeping, and in the case of what might be termed "weekly boats" such provisions as meat, fish, etc., stored in the forecastle, should be at least changed.

HEATING.

The earliest method of heating was by stoves, and today in many instances this type is still in existence. My own opinion is that in many cases it is the best means of heating remote parts of the ship, but not the usual type as usually seen. A proper ventilating stove would solve many problems, but to allow the use of an ordinary cast-iron stove with a funnel passing through the ventilator, stopping ventilation and pouring poisonous carbon monoxide into the air, to say nothing of organic particles in the air giving rise to a sickly odor, is a condition which cannot be too strongly condemned.

Steam heating is handy, and, if combined with ventilation, is satisfactory. Dr. Reed, M. D., says the following about steam heating: "No system of warming by hot pipes is advisable unless both inlet and outlets are provided for ventilation," and from this it is obvious the practice of introducing a series of steam coils or pipes only is harmful and objectionable, only less so than unhealthy oil stoves, heated bricks, or drums of hot water frequently changed.

The coils are usually placed in out-of-the-way corners, they collect dirt and filth, which is duly baked and dispersed in fine powder to be breathed by the inmate, or where a pipe is led along the floor of a cabin, collecting around it all the debris. Leakage of joints makes the berths damp and the noise caused by water-hammer action, the minor trouble, is certainly undesirable and frequently extremely objectionable.

In connection with heating and ventilation system the patent ventilating thermo tank is good.

The system consists of a cylindrical tank fitted with tubes from end to end, the whole being enclosed in an outer casing, connected with which is the discharge fan.

The heating medium (steam) circulates in the cylinder (round the tubes), while the air to be heated passes through the tubes.

The system can be admirably adapted for cooling the entering air (for vessels trading in the tropics) by connecting the thermo tank to the refrigerating brine circuit, or connecting the tank to the refrigerator, upon the expansion system.

SHIP YARD NOTES.

The Moran Co., Seattle, Wash., will soon lay the keel for a fourth steel freighter of the type of the Riverside, Falcon and Stanley Dollar. The owners are reported to be San Francisco shippers.

The Skinner Ship Building & Dry Dock Co., Baltimore, Md., has a large car float for the Atlantic Transport Co. nearly completed. The vessel is 224 ft. long, 34 ft. beam and 8 ft. deep and is to be used in Baltimore harbor.

Hall Bros., Port Winslow, Wash., have a contract for converting the bark Fresno, recently purchased by the Tyee Whaling Co., into an oil barge for carrying whale oil from Alaska to Puget Sound ports and San Francisco, Cal.

The New London Marine Iron Works, New London, Conn., has been awarded contract to build a large wooden scow for the United States engineer corps to be used in the dredging work now being carried out at Hell Gate, New York harbor.

The Fulton Iron Works, one of the best known companies of its kind on the Pacific coast, recently announced that owing to lack of business it will go into voluntary liquidation of its affairs. It is stated that the company's liabilities amount to $1,028,149 and that the assets will exceed this sum.

The Oregon Dry Dock Co., Portland, Ore., is a new incorporation by capitalists of that city. Dredging has already been begun and a structure will be erected alongside of the Willamette Iron & Steel Works plant. The dry dock is to be 336 ft. long, 76 ft. wide and is to have a lifting capacity of 4,000 tons dead weight.

R. L. Bean, Camden, Me., who is conducting the ship yard formerly operated for many years by his father, H. M. Bean, is getting out the material for a schooner of 700 tons' capacity for Capt. S. W. Theall, of Chelsea, Mass. He is also reported to have contract for a 1,200-ton schooner to be started so soon as the Theall hull is in the water.

Crawford & Reid, Tacoma, Wash., are rushing the fishing steamer Andrew Weiding, building for Capt. Weiding, to completion at a rapid rate. She is 127 ft. long, 24 ft. beam and 14 ft. depth of hold. She is built of fir and is of very strong construction as is required in the halibut trade in which she will engage. The machinery is being built by the Washington Iron Works, of Seattle, Wash., and consists of an engine of the compound type with cylinders 11 and 25 in. in diameter and 24-in. stroke. There will be a Scotch marine boiler 9 ft. 6 in. by 9 ft. 6 in. fitted with Morrison corrugated furnaces and designed for a working pressure of 175 pounds.

J. H. Hammitt, Marietta, O., is building a steamboat to be called Louise Rivers and also one to be known as Robert Rhea. The latter is nearing completion and is destined for the Cumberland river trade. The Louise Rivers is progressing rapidly. She will be 124 ft. long and 31.5 ft. beam. Her engines are to have cylinders 17 in. in diameter with 6-ft. stroke. There will be three boilers 22 ft. long, 44 in. diameter.

Kruse & Banks, Coos Bay, Ore., have been awarded contract for the construction of two new car floats for the Western Pacific Railway Co. to be used in handling freight on San Francisco Bay. They are to be ready for service in seven months. These floats will be 272 ft. in length over all, 39 ft. beam and 12 ft. 6 in. deep. These floats are to be towed by the 700-H. P. tug which is now under construction by the Craig Ship Building Co. at Long Beach, Cal.

The Bertelsen & Peterson Engineering Co., East Boston, Mass., is to furnish machinery for a new tug now being built by A. C. Brown & Sons, Tottenville, Staten Island, N. Y., to the order of the Packard Dredging Co., of Providence, R. I. The hull is of white oak, 100 ft. in length over all, 25 ft. beam and 11 ft. deep. The engine is to be a fore and aft compound with cylinders 16 and 34 in. by 26-in. stroke, with 650 I. H. P. The Kingsford Foundry & Machine Works will supply the Scotch boiler which will be 11 ft. in diameter by 13 ft. long.

The New York Ship Building Co., Camden, N. J., has a contract with the Lehigh Valley railroad for the construction of seven steel seagoing barges to be 197 ft. long over all, 35 ft. beam and 17 ft. 6 in. deep. They are to be schooner rigged with three masts and will be provided with two water tight bulkheads, one in the bow and one in the stern as well as with three non-water tight bulkheads for dividing the cargoes. The barges will carry 1,620 tons on 14 ft. 6 in. draught and 2,000 tons on 17 ft. draught.

Crawford & Reid, Tacoma, Wash., are getting out the material for the hull of the new steamer which they are to build for Capt. Matthew McDowell, of Seattle, Wash. She is to ply on the East Pass route between Seattle and Tacoma and will be one of the fastest of the smaller vessels running between these points. She is to be 119 ft. long, 19 ft. beam and will be fitted with an engine of the Marshall type of valve gear, with

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cylinders of 10, 17¼ and 28-in. diameters by 16-in. stroke. Steam is to be supplied by a Taylor boiler. The Hutton Engine Works, of Seattle, are to furnish the machinery.

The Craig Ship Building Co., Long Beach, Cal., has been awarded contract by the Western Pacific Railway Co. for the construction of a wooden tug boat for towing car floats in San Francisco harbor. The hull will be 120 ft. long, 24 ft. beam and 12 ft. deep. The engine is to be of fore and aft compound condensing type, with cylinders 20 and 42-in. diameter by 24-in. stroke and with 700 I. H. P. The boiler is to be a Babcock & Wilcox water tube type, with 2,500 sq. ft. of heating surface and 66 sq. ft. of grate surface, with oil-burning furnaces. A working pressure of 175 pounds is allowed to the square inch. The contract price for the boat complete is $63,400 and it is to be ready for service in seven months..

The Hewitt Dry Dock Corporation is a new company formed recently at Tacoma, Wash., for the purpose of erecting a dry dock plant at the mouth of Chambers creek and for building and repairing ships, widening, clearing and deepening lakes, rivers or creeks, building and erecting docks, wharves and warehouses and maintaining and operating railroads and other projects. The proposed methods of construction are to build a concrete dam and gate across the mouth of Chamber creek, with a dividing wall up the center of the creek valley, which is closed in by high banks. This would make practically two docks side by side, with a working capacity of one mile and room for half a dozen of the largest steamers afloat to be in dock at the same time. The method of operation will be to float a ship into one side of the dock, letting in the water from the creek, filling up the dock and floating the ship up to a height of 40 ft., resting it on the gridirons at the outer side of the dock. The waters of the creek are then to be diverted, leaving the dock dry.

The Moran Co., Seattle, Wash., is preparing plans for a 600-ft. sectional steel dry dock in which all the latest ideas in floating dock construction will be embodied. The dock will be constructed in its entirety at the Moran plant and when complete will be capable of handling any ship afloat on the Pacific. It will consist of three sections each 200 ft. in length or 600 ft. total length; length over platforms 640 ft.; extreme breadth, 128 ft.; breadth inside wall at top, 110 ft.; breadth inside wall at floor, 100 ft.; depth of pontoon, 15 ft.; total depth, 52 ft.; displacement, 40,000 tons; lifting capacity, about 20,000 tons; capacity for a ship 600 ft. long by 75 ft. beam by 26 ft. draught. Each of the three sections will be fitted with a centrifugal pump, each taking care of its own part. These centrifugal pumps will be driven by electricity, and each tower will be equipped with a traveling crane, to handle plates on and off a vessel in dock. The dock will be so constructed that two sections can be joined together and, if necessary, can lift the third section for any work to be done thereon. The dock will be equipped with hydraulic keel blocks. The company has 200 acres of ground adjoining its plant, and it is probable that a location for the dock will be selected on this land.

King & Winge, Seattle, Wash., have the steamer Sentinel beached at their yard for repairs to the injuries which she sustained in her recent collision with the steel steamer Chippewa at Seattle in a fog. The Sentinel had a large hole stove in her bow above the water line.

Hendry & Son, Liverpool, Nova Scotia, launched a tern schooner called Medway recently. She is 115 ft. long, 25½ ft. beam and 11 ft. depth of hold. She is of the latest type of hull and deck plan for a fishing vessel of the larger class as well as for general freighting.

The Sharptown Marine Railway, Sharptown, Md., has begun rebuilding the hull of the burned steamer Cohasset which they purchased some time ago. This company also has ready for launching a sea-going barge for the P. Dougherty Co., of Baltimore, Md.

The Union Iron Works, San Francisco, Cal., is making rapid progresson the repairs to the German Kosmos line steamer Anubis. At the present rate of speed it seems likely that the repairers will complete the job under the specified time, and receive a bonus for time saved.

Charles L. Rohde & Sons, Baltimore, Md., have the frame up for a lighter for use in Baltimore harbor.

The Tietjen & Lang Dry Dock Co., Hoboken, N. J., has the govenment dredge Raritan at its yard for extensive repairs. They are estimated to cost $10,000.

Oliver Reeder & Son, Baltimore, Md., have nearly completed the lighter which they are building for the Empire Coal & Coke Co.

The new Burrell-Johnson Iron Co., of Yarmouth, N. S., has started work upon a large steel tug which it is to build for the Canadian government for use in towing scows in dredging work.

Counsel for the receiver of the Neafie & Levy Ship & Engine Building Co., of Philadelphia, have sent a circular to creditors stating that a motion will be made in court Oct. 16, to confirm the sale which was made at auction last July for the sum of $50,000, subject to a mortgage of $277,000 and ground rent. If any of the creditors object to such confirmation they are to be represented by counsel. In case the court confirms the sale the creditors will have little chance of obtaining any adequate settlement of their claims.

W. C. Smith, Lunenburg, Nova Scotia, launched the 98-ton fishing schooner Frank D. Cook recently. She is 20 ft. in length over all, 90 ft. keel, 26 ft. beam and 11 ft. depth of hold.

Crawford & Reid, Tacoma, Wash., have the steamer City of Shelton on the ways for extensive alterations and repairs. The City of Shelton has been for a long time on the Olympia-Shelton run alternating with the steamer J. C. Simpson.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., launched the steamer Southland, building for the Norfolk & Washington Steamboat Co., of Washington, D. C., Oct. 3. She is 305 ft. in length, 51 ft. beam and 17.9 ft. deep.

Frank S. Bowker & Son, Pittsburg, Me., launched the three-masted schooner Frank B. Witherbee on Oct. 10. She was built for Rogers & Webb, of Boston, Mass., and was launched ready for sea. Work will begin at once on another three-master.

William E. Woodall & Co., the Baltimore ship builders, have a large six-pocket mud scow in frame. Work is also progressing on the two freight lighters which they are building for the Southern Products Co., of Baltimore, for use in carrying garbage from the city to its plant near Magothy.

The Merrill-Stevens Co., Jacksonville, Fla., recently lengthened the government dredge Florida 20 ft. She is now 174 ft. long and draws several inches less water than before the alteration. She is employed in the work on the Manatee river, Florida.

Crawford & Reid, Tacoma, Wash., have the gasoline schooner Ida May, which was run down by the Canadian Pacific liner Princess Victoria, at their yard for repairs. The Ida May is an 80-ft. vessel and was on her maiden trip when the accident occurred. She has a hole in her port bow nearly 7 feet wide.

The St. John Ship Building Co., St. John, Ore., in conjunction with the John Wood Iron Works, of the same city, have been awarded contracts for constructing a ferry steamer for the Portland Railway, Light & Power Co., Portland, Ore. The craft is to ply between Vancouver, Wash., and the Oregon side, and will cost $26,000.

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THE CONTRACTOR'S PLANT AND METHODS ON MARE ISLAND DRY DOCK NO. 2.

(From *The Engineering Record.*)

(Continued from Oct. 8.)

The portion of the piles bearing against the walings of the crib acts as a continuous beam when the water is pumped out of the cofferdam. The length between the lowest waling and some point of support in the mud was also known to be a part of this continuous beam, if that point of support could be determined to be sufficiently rigid, as it evidently was from the driving. In order, however, to locate accurately the line of support for the lower end of the sheet piles, the clusters of the round piles used to support the guides of the crib were snapped off. The lowest grade at which these piles broke was approximately at the dredging line, which demonstrated that the part of the sheet piles below the lowest waling also acts as a continuous beam, with a maximum span of 12 ft. between the lowest supports, which was assumed to be the worst condition. A section of pile tested under a 12-ft. span, with one end of the beams free and the other end partially fixed, carried a load of 5,000 pounds per square foot with a maximum deflection of 1 in., while the maximum load on the sides of the cofferdam is only about 3,000 pounds per sq. ft. and is distributed under more favorable conditions.

After the sides of the cofferdam had been made as tight as possible under water, pumps were started to remove the water from the enclosed space in order to locate further leaks and to determine the strength of the structure. As the water level was lowered such few leaks in the sheeting as occurred were plugged, and eight 3 x 3-ft. flood gates, which had been placed in the sides and the outer end of the cofferdam, were caulked. Two 15-in. centrifugal pumps lowered the water to the fourth course of timbers from the top of the crib, and after that depth was reached two 8-in. centrifugal pumps were added. Three-quarters of the total leakage up to this time was through the butt joints between the two timbers of each sheet pile. The hard driving had forced the oakum out of these joints, which it was then evident would have been better with a pin connection as a stop-water. The first row of these butt joints was plugged with shingles from the inside after the water had been drawn down, and then the water was lowered to below the second row, 26.5 ft. below mean tide level, where one 15-in. and one 8-in. pump held it until those joints were also plugged.

Meanwhile, a 1½-in. opening between the regular sheet piles and a group of four patch piles, bolted together, near the head of the dock scoured a V-shaped hole, 9 ft. deep, on both sides of the sheeting in the conglomerate formation. This hole, when filled with concrete in bags on the inside, and clay on the outside of the sheeting, gave no further trouble. The following day another leak occurrred near the head of the dock, where five of the sheet piles had a penetration of from only 2½ to 3½ ft., having landed on a pocket of disintegrated sandstone. Irregular strata of shale and clay run diagonally under the sheeting close to this point, with occasional pockets of this disintegrated sandstone, which slakes rapidly in water or in air. The water had undercut through one of these pockets, and the leak, which appeared out some 25 ft. from the sheeting in the cofferdam, was of such magnitude that the flood gates were opened and the cofferdam allowed to fill. Afterwards, 110 cu. ft. of concrete were placed in this hole inside of the sheeting, and 10 cu. yds. outside before it was filled.

Seven-eighths of the total length of the sheeting walls were driven 12 to 14 ft. in good clay, in which no undercutting would occur, and in this part of the cofferdam the only danger was from an opening in the sheet piling acting as a jet to cut its way down through the clay. These places had been detected and soon closed, so no trouble was anticipated from them. The decision was made, therefore, to puddle around the outside of the sheeting at the head of the dock for a distance of about 250 ft., where the piles had penetrated 7 to 10 ft., but were in the broken, irregular formations of clay and shale. Meanwhile, the fissure in the disintegrated sandstone, which had cut down 9 ft. below grade, had to be carried 8 ft. farther before the bottom of the pocket was reached. This hole was then filled with concrete in bags by a diver, and the puddle placed over it.

When the puddle had been placed around the head of the dock to a depth of 6 to 10 ft., the water was again pumped out of the cofferdam. Three pumps, an 8-in. and two 15-in. centrifugals, required nine days to lower the water level to the heads of the piles. It had been anticipated that less time than this would be necessary to unwater the cofferdam, but the strips of canvas over many of the cracks had rotted, since the canvas only lasts about two weeks under water. These openings were therefore wedged up on the inside with shingles as the water was pumped down.

During the period of pumping from the second course of timber in crib down, a patrol of four men was constantly searching for signs of scour with long poles. The water level was held down to the pile heads for two days with no signs of a bottom leak, and no evidence of weakness in the cofferdam. A scour then occurred near the head of the dock in a pocket of conglomerate underlying a bed of blue clay. This conglomerate was washed out, leaving the clay supported against the sheeting, and appeared 24 ft. inside the latter. Efforts to stop the leak were of no avail, so the flood gates were again opened in order to fill the cofferdam and prevent any serious consequences.

At the time the cofferdam was flooded there were no evidences of any other scours or leaks, the water level being held down by one 15-in. centrifugal pump. The significance of this condition can scarcely be appreciated, as the sheeting offered a wall, 1,960 ft. long, with about 11 miles of joints in it, against which there was a sheer head of water of 48 ft. at high tide. Practically the only leakage into the cofferdam was through cracks below the lowest course of walings, which did not produce sufficient water to flush out the accumulation of silt over the piles. In fact, four 4-in. syphons and two 4-in. discharge steam pumps supplying six lines of 4-in. hose were all discharging water into the off-shore end of the cofferdam for this purpose when the latter was filled the second time. The water which leaked into the cofferdam, added to that from the two 4-in. pumps and the four syphons, was not more than the 15-in. centrifugal pump could handle.

The strength and general tightness of the long, high walls of the sheet piling having thus been fully determined, it was evident that underscouring through pockets in the unusually irregular strata of clay and shale at the head of the dock was the chief danger to be overcome. By any other means, except in an open caisson, the mud and silt which had accumulated over the heads of the piles to a depth of as much as 6 ft. would have to be removed under water and the bottom of the cofferdam sealed with concrete in the same manner, all of which would have been done with great difficulty. The decision was accordingly made to

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place puddle back-fill around the outside of the sheeting up to the low-tide level, thus greatly reducing the head against the sheeting, and the possibility of underscouring in the irregular formations. This method had previously been contemplated, but it was desired to avoid it at this time, in order to make the fill while the concrete work was in progress, since the contract had been badly delayed, due to the inability to secure materials.

A borrow pit was opened in a hill above the shop building of the navy yard to obtain material for the back-fill. This hill is an irregular formation of shale and clay, exactly similar to the material around the head of the dock. The material, when deposited around the sides of the sheeting, pushed back the silt, which had accumulated there to a depth of several feet, and settled into the stratum of black clay under this silt, forming a quite satisfactory puddle.

In all about 52,000 cu. yds. of the puddle was required to make the back-fill up to low-tide level. A steam shovel was installed in the borrow pit and the material was delivered over the tracks in the navy yard in trains of 5-yd. dump cars. A track was laid along each side and the inshore end of the cofferdam to permit the material to be deposited directly in place. Various conditions in the navy yard hindered this work, but on an average 1,000 cu. yd. of material were delivered every 24 hours over a single track ¼-mile long leading through the yard, with 17 switches in the track.

After the fill had been carried up to low-water level, the two 15-in. pumps were started and the water level lowered to the tops of the piles in three days, exposing the mud which stood over the heads of the piles. This might appear to be too rapid work, but the cofferdam had been pumped out previously, so the sheeting had all taken bearing; as the fill had also been deposited through the water it was therefore thoroughly packed, so, on the whole, no danger was anticipated in removing the pressure from the inside of the cofferdam. It was not considered necessary to install additional pumps, since the small openings in the sheet piling had all been wedged when the cofferdam was pumped out before, so the latter was practically tight, the backfill making it even more secure.

During the 21 months which elapsed after the cofferdam was built, until it was finally unwatered, 18,000 cu. yd. of silt had been deposited, from the water, around and over the heads of the piles driven to provide a foundation for the dock. At the time this article was prepared the silt was being sluiced to the pumps at the land end of the dock. The bottom of the cofferdam was divided into three longitudinal sections of four panels of the timber crib each, with the intention of cleaning the mud from one side section and placing the concrete in the latter to a depth of 2 ft. Then the other side was to be cleaned and concreted, after which the mud would be cleaned from the four center panels and the concrete placed in them, thus forming a 2-ft. concrete seal over the entire bottom. The mud was loosened with jets from nozzles supplied by a reciprocating pump on top of the crib. Sufficient water to carry the loosened material to the pumps was admitted through gates in the sides of the cofferdam. By working laborers in three 8-hr. shifts, it was possible to remove, in this manner, 2,000 cu. yd. of material a day, with an 8-in. and two 15-in. pumps, the latter carrying 10 per cent solid matter in solution.

Two 15-in. centrifugal pumps, on which dependence will be placed to keep the water level in the cofferdam lowered, are each arranged on an elevator cage so they can be raised and lowered with the variations in the water level, or lifted above the top course of the timbers of the crib. Each pump is placed on a 6½ x 10-ft. platform, built of 6 x 8-in. timbers, and is belt-driven by a 120-H. P. electric motor on a platform 14ft. above it, the two platforms being connected by eight 6 x 6-in. uprights, which are cross-braced thoroughly and form the cage. The latter operates in a timber guide frame, built up on the top timbers of the crib, and is suspended from this frame by a steel cable on triple purchase sheave wheels. The two guide frames are set at the inshore end of the cofferdam, where the discharge pipes can be dropped over the sides. Each cage can be readily raised and lowered by traveling derricks, which operate on top of the crib. The suction head is thus greatly reduced by being able to alter the position of the pumps, and danger of the pumps being submerged in case the cofferdam is filled suddenly is avoided.

Since danger of flooding the cofferdam will exist at all times under the most favorable circumstances that can be obtained, it is essentially necessary that arrangements be made to place the volume of over 80,000 cu. yd. of concrete required in the dock with all possible speed. To this end, a very complete material and concrete handling plant has been installed. The controlling features of the arrangement of this plant were to be able to pass all materials through it in as nearly a straight line as possible, and to insure a continuous output during three 8-hr. shifts under practically all conditions. As no suitable sand is obtainable in the immediate vicinity, one of the scows that had been rigged previously as a pile-driver outfit, was fitted up as a dredge to pump sand from the bed of the Sacramento river, 42 miles above the site. In that locality the bed of the stream is composed of a remarkably clean, sharp sand. The dredge has an 8-in. centrifugal sand pump, belt-driven by a steam engine, and can deliver 50 cu. yd. of sand an hour to scows under the operating conditions. The scows were towed to the dock by a gasoline tug until a larger tugboat could be placed in commission for the purpose.

The crushed stone is furnished by a quarry 24 miles distant on the shores of San Pablo Bay. It is loaded into 600-cu. yd. scows, which are also towed to the site.

An elevated storage pocket divided into two compartments, one for sand and one for broken stone, has been erected on a pile foundation, with its adjacent end about 50 ft. downstream from the dock, and with its longitudinal center line coincident with the longitudinal axis of the dock. The concrete mixing plant is a three-story tower against the off-shore end of the cofferdam. This tower is carried by piles, and has its transverse center line coincident with the longitudinal center lines of the cofferdam and storage pocket.

The elevated pocket is 30 x 300 ft. in plan, and rises to a total height of 32 ft. above mean low tide. It stands on 89 transverse pile bents, each of which contains four piles ranging from 80 to 100 ft. in length. These piles were driven to a penetration of as much as 75 ft. in places without fetching up, as the stratum of blue clay underlying the site of the dock drops away at the off-shore end of the latter to an undetermined depth. Batter piles were driven on both ends of every fourth bent to prevent lateral motion, and as all of the piles under the structure assumed a comparatively large carrying capacity soon after they were driven, no apparent settlement or weakness has been detected when both pockets were fully loaded, bringing approximately 30,000 pounds on each pile.

A tight floor is erected over the caps of the pile bents, the bottom of

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the pocket being 7.5 ft., on the average, above this floor, as the inshore end of the pocket is 3 ft. lower than the off-shore end. The pocket is carried directly by four longitudinal rows of 12 x 12 in. timbers, spaced 4 ft. apart on centers in the rows. The two rows on each side of the center line are spaced 10 ft. apart transversely, in order to provide room between them for a standard-gage track to be laid on the floor over caps of the piles.

The two compartments of the pocket are each 30 x 150 ft. in plan, and 12 ft. deep, each having a capacity of 2,500 cu. yd. The sides and ends of the compartments have 3 x 12-in. uprights lined with 2 x 12-in. plank placed horizontally. The bottom of the compartment is built in the shape of two longitudinal hoppers, with the center line of each hopper over one of the two longitudinal standard-gage tracks laid on the floor over the pile caps. Two rows of 12 x 12-in. openings are placed in the bottom of each hopper, the openings being 10.5 ft. apart in the rows, and controlled by a double-lip under-cut operated by a hand lever from the track floor. These operating levers are at the sides of the track, where they can be reached without interference from a car on the track.

The scows in which the crushed stone is delivered have horizontal belt conveyors placed under a row of openings in their docks, which conveyors deliver to a bucket elevator carried by a boom. The latter is arranged so it can be raised and lowered, and has sufficient length to enable the elevator to deliver into the stone pocket. Two of the stone scows, each with a capacity of 600 cu. yd., are provided to insure a supply.

The sand is hoisted into the sand pocket by means of a ¾-yd. Hayward clam-shell bucket handled by a stiff-leg derrick traveling on top of the pocket. The derrick platform travels on a rail on top of each side of the pocket, and carries two derricks, one to serve scows on each side of the pocket. Each derrick is equipped with a 10 x 12-in. Lidgerwood engine, and can handle 35 cu. yd. of sand an hour.

The cement used in the concrete is made in the mill of the Standard Portland Cement Co., at Napa Junction, 6 miles from the work, and is delivered to the dock in a scow having a capacity of 2,000 barrels. This scow is covered with a tight shed to protect the cement from the weather. A cement storage shed, with a capacity of 12,000 barrels, has also been erected on the edge of the shore adjacent to the inner end of the sand and stone pocket. The cement scow is moored in the slip between the pocket and the storage shed, where it can be reached by a 65-ft. boom stiff-leg derrick mounted on a section of the old earthfill cofferdam. The location of this derrick is such that it can reach cars on a track leading into the cement shed, or a 4 x 6-ft. hatchway in a floor over a 15 x 30-ft. working platform level with the floor of the pocket, at the inshore end of the latter. The derrick handles light wooden slings, capable of holding 40 sacks of cement. While the scow is at the work the cement required in the mixing plant is handled by the derrick directly to the working platform at the end of the sand and stone pocket. The derrick is also used at the same time to deliver cement from the scow to cars, on which it is carried into the cement shed. When the scow is away securing more cement, the stock in the shed is used. With this arrangement much of the cement has to be handled only once, while a stock adequate to insure against emergencies is available.

The floor of the first story of the tower of the concrete mixing plant is level with the top course of timbers in the crib, and also with the floor carrying the two tracks under the sand and stone pocket. Those two tracks extend from the end of the pocket up to the third story of the tower on an incline. The second story of the tower contains the concrete mixer, and the first story tracks leading out over the crib of the cofferdam. The whole concrete mixing and handling plant is designed to handle 2½ yd. batches, and has been demonstrated to have a nominal average capacity of 100 cu. yd. per hour, with a force of 60 men, including the materials-handling crews and the concrete gangs in the cofferdam.

A hopper car divided into two steel lined compartments, one for sand and one for stone, with a combined capacity of 2½ yd. in the two compartments, is operated on each of the two tracks extending under the sand and stone pockets. Materials will be drawn first from one side and then from the other side of the pockets to avoid trimming in the latter. The two cars are handled along the tracks and up the incline leading to the third story of the mixer tower by a double-drum Lidgerwood hoisting engine in the three-story mixer tower beyond the head of the incline. After one compartment of a car is first filled with stone from the gates in the pocket, the car is pulled ahead and the other compartments filled with sand, marks in the hoppers indicating the amount of each required. The cement is then added through an undercut gate leading from the bottom of the working platform at the shore end of the pocket. One of these cement hoppers is placed over each track, only enough cement being stored on the platform to meet momentary fluctuations. The loaded car is hauled up the incline and dumped by means of a gate in the bottom of each hopper of the car into a hopper under the track, the empty car running back down the incline by gravity. The gates under the sand and stone pockets and the car hoppers are so arranged that a loaded car can be delivered to the mixer tower on each track fast enough to insure the capacity of the mixing plant to be maintained, in case one track is out of service.

A 2½-yd. Ransome concrete mixer, specially arranged for this contract, is mounted in the second story of the tower, where it is fed directly by the hopper under the head of the tracks on the incline. This mixer is belt-driven by a 40-H. P. electric motor and discharges through the second floor into buckets on cars on the track below. Water is supplied to it from a measuring tank on the floor above, a quick-opening valve, operated from the floor below, controlling this tank. The gate on the track hopper supplying the mixer is also controlled from the same position, so one man feeds the mixer and attends the motor. A second man handles the balanced discharge chute of the mixer.

Two parallel standard-gage tracks extend the length of the cofferdam, 5.5 ft. on each side of the longitudinal center line. The concrete is discharged from the mixer into 2½-yd bottom-dump buckets on flat cars on one of these tracks. These cars are hauled out on the track by a C. W. Hunt steel cable car haul. The engine driving this car haul is placed under the shore end of the sand and stone pockets. The cable extends out on the loaded car track, around a sheave wheel at the end of that track and back on the empty car track. Each car is equipped with a clutch which is attached to the cable when the car leaves the mixer tower. As the speed of the cable is about as fast as a man walks, a rider is not required on the car, the clutch being released by a man along the track when the car reaches the desired position.

Two gangs of concrete men are worked in the dock, one on each side

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of the center. Ten of the 2¼-yd. bottom-dump buckets are provided, five of which are painted red and the remainder black, the red buckets serving one gang and the black ones the other. The gang for which the car is designated is thus evident and mistakes are avoided.

The buckets are handled from the cars to place by four traveling stiff-leg bull-wheel derricks, two of which travel on four rails on each side of the two cement car tracks. These derricks are all standard sizes, their corresponding parts and castings all being duplicates. In fact, the various parts of all the derricks on the contract are made thus and the patterns for the cast parts were retained in order to facilitate repairs. Each derrick has a triangular platform carried by six pairs of traveler wheels and is operated by a double-drum Lidgerwood hoisting engine, with a bull-wheel turning drum.

The various derricks and other plant around the work, except the concrete mixer and the two 15-in. centrifugal pumps, are operated on steam delivered from a central station on the shore. This station contains 300 H. P. in boilers, and is about 350 ft. from the off-shore end of the cofferdam. A 6-in main steam line is carried overhead from it to the longitudinal axis of the cofferdam, from which point a 4-in. branch extends the length of the dock, and a 3-in. branch extends to the sand and stone pocket. Hose couplings are placed in these branches at various points, in order that the construction equipment may be served conveniently at any part of the work. The main steam lines are all covered with wool wrapped in painted canvas to reduce the loss due to radiation. The connections at various points are made with wire-wound rubber hose. A complete system of drip pipes is provided to return the condensed water to a hot well at the station.

Under the existing conditions this method of power transmission is considered the most feasible and economical that could be provided. In the first place, it is believed to be more certain than the electrical power that is available. On the other hand, the loss by condensation in the long steam mains is relatively low, since the temperature in this locality rarely, if ever, reaches the freezing point. Moreover, a separately-fired boiler for each of the derricks would have required a number of high-priced firemen that are thus eliminated; and these boilers scattered around the large timber structures would have offered a constant fire hazard of serious moment. Steam coal is also worth $12 to $14 a ton, while fuel oil is obtained at 57 cents a barrel and can be stored in a 2,000-bbl. tank adjacent to the central station, whereas it could not be used with any degree of safety to fire boilers around the timber structures.

The central station contains an air compressor, with a capacity of 125 cu. ft. of free air per minute, which supplies a system of pipes extending to all parts of the work. This air distribution system was used to special advantage during the construction of the crib and so forth in connection with air-driven boring machines and hammers.

A completely equipped machine shop in which all minor repairs to equipment can be made adjoins the central power station. Heavy repairs are mostly made in the adjoining shops of the navy yard, or in various private shops in San Francisco.

The plant of the Scofield Construction Co. was designed and the methods followed were devised up to the time this description was prepared with E. M. Scofield as chief engineer and Francis B. Smith as superintendent in immediate charge.

PRODUCER GAS.

(Continued from page 19)

without an independent boiler. The consumption of water is the same in both types. It is also worth mentioning that where there are several engines to serve, the arrangement of the gas pipes is greatly simplified, and their cost is proportionately reduced, when the gas can be taken from a small gas holder instead of from several suction plants.

There is not time to deal fully with the economical and commercial aspects of the subject, but I may state generally that the results obtained are most encouraging. In large furnace work many operations are now performed with producer gas which cannot be accomplished with solid fuel, and there are many others which can be performed with either solid or gaseous fuel; with the latter the heat is not only more regular and more easily controlled, but the work done costs less, and the wear and tear of the furnaces is also less. In many industrial processes where jets of gas are required producer gas is now used instead of ordinary town gas, and the saving effected is usually from 50 to 60 per cent, including fuel, wages, and repairs. In engine work there are now hundreds of thousands of horse-power working regularly and satisfactorily with producer gas. In this connection the gas plant has come to stay, and steam power has a serious rival; in some cases the pressure type is better than the suction type, in others suction is better than pressure. Each has its own province, and in each the consumption of anthracite is now guaranteed not to exceed 1 lb. per brake horsepower-hour under a full or three-quarter load. With low loads the consumption is a little more. It only remains for me to say a few words about the nature of the fuel required for producer gas. For engines or for heating with small burners, the best and cleanest gas is made with anthracite, as it does not yield tar; this not only simplifies and cheapens the plant, but it also reduces the cost of labor in working it. Where anthracite is too dear ordinary gas coke can be used, provided that it is well carbonized, that it does not contain too much sulphur, and that it is not mixed with pieces of coal. Non-caking bituminous coal is almost invariably used for large furnace work, and there are some plants which make gas from this fuel for engine and other work. But these plants are rather complicated and costly, and they cannot be recommended for small powers. They require constant attendance, whereas a plant working with anthracite or coke can be left for several hours—what is gained by using the cheaper bituminous coal for small plants is lost by the additional cost of labor. It is probable that in the course of time these drawbacks will be overcome, but for the present anthracite and coke can be used, and with these the adoption of producer gas for engine work continues to advance most satisfactorily.

The Price ship yard at Bandon, Ore., will launch two tugs this month. One is building for service on the Coquille bar and the other for the Umpqua.

BIDS FOR BUOYS.

Bids opened Aug. 25 by the inspector of the third lighthouse district, Tompkinsville, N. Y., for furnishing acetylene buoys for the third, fifth and sixth lighthouse districts, were as follows:

United States Marine Signal Co., New York $5,062
Gas Accumulator Co., New York..... 4,650

BIDS FOR SPEED WHEELS.

Bids received by the lighthouse engineer at Mobile, Ala., on Sept. 12 for furnishing one pair of metal speed wheels for the lighthouse tender Arbutus, were as follows:

*A. Wells Case & Son, Highland Park, Conn. $830
H. G. Trout & Co., Buffalo, N. Y..... 940
John W. Sullivan Co., New York. (Bid not in accordance with specifications).

*Accepted.

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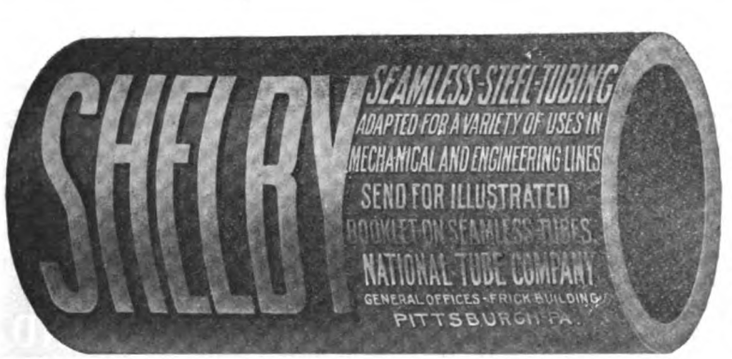
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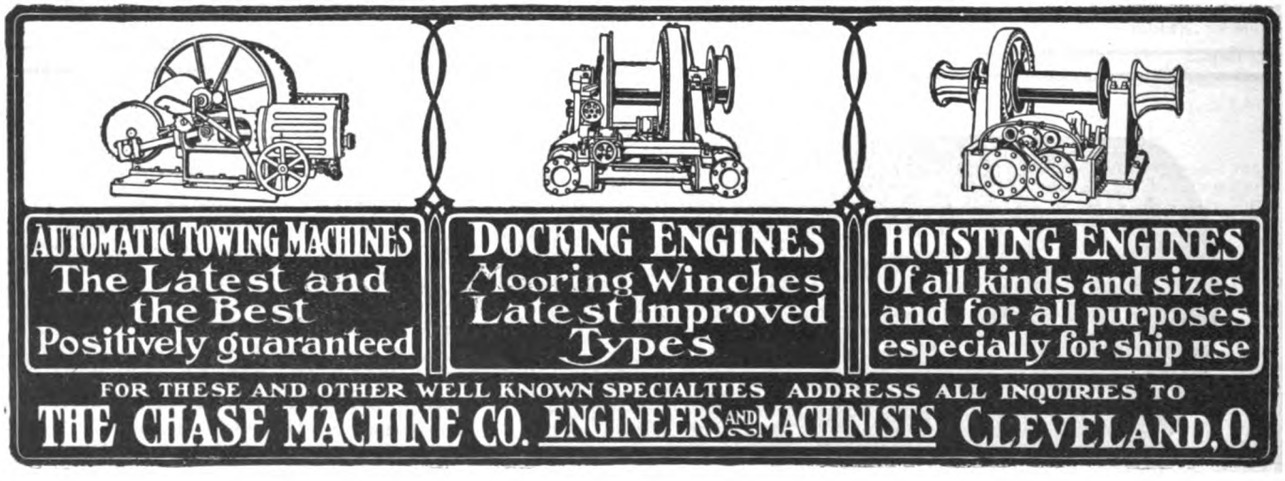
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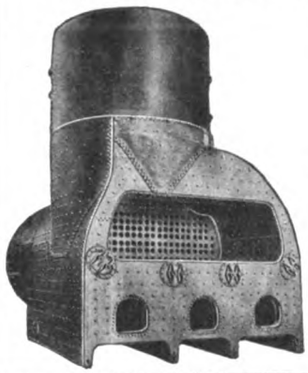

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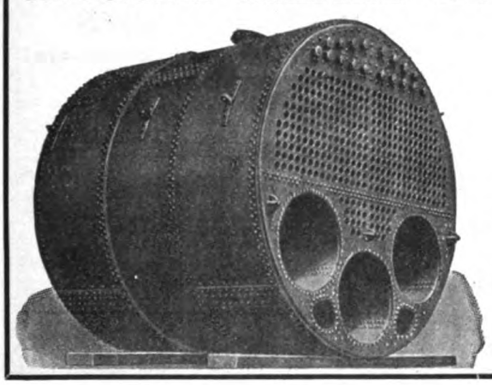

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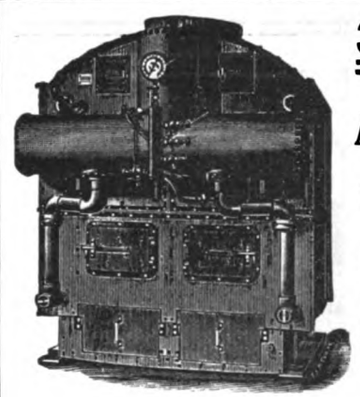

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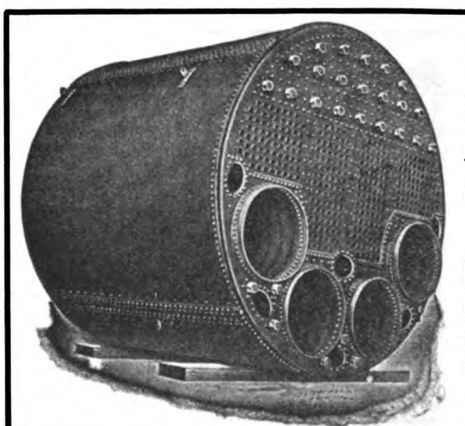

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